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HERMAN LUDWIG FERDINAND VON HELMHOLTZ.

On September 8, 1894, after seventy-three years of life, which yielded a record almost unsurpassed of work in physiology, anatomy and physics, Von Helmholtz died. The combination which he possessed of mathematical and experimental talents of the highest order, backed by a medical education, placed much of his work in the intermediate regions between physiology and physics, gave his investigations a peculiarly practical value and caused them to influence surgical practice on the one hand, while his work in pure science has enlightened the world of science.

Herman Ludwig Ferdinand von Helmholtz was his full name. He was born in Potsdam, August 31, 1821, in which city his father held a position as a teacher in the "gymnasium" or elementary school. When seventeen years old he entered the University of Berlin in the Frederick William school, taking up the study of medicine. He desired to be a physicist, but circumstances forced him to take the more practical course of medicine. Later in life he was pronounced in his views of the great utility of the study of medicine to himself, as a guide and basis for his later work in physics.

In 1841, sick with typhus fever, he was treated in the Charité hospital gratuitously, a privilege which was his due as a student. On recovering he received the portion of his income which had accumulated during his illness, and this money he at once devoted to the purchase of a microscope, and began to study the nervous processes of the ganglion cells of invertebrates. These studies were used in his graduating thesis, and in 1842 he received his doctor's degree. In 1843 he published a work on putrefaction and fermentation, rejecting Liebig's chemical theory, and laying the foundation for the modern biological treatment of the subject. He was military surgeon in Potsdam during this period, yet prosecuted his work in science, in 1845 preparing an article on heat for a medical dictionary. The sub-

HERMAN LUDWIG FERDINAND VON HELMHOLTZ.

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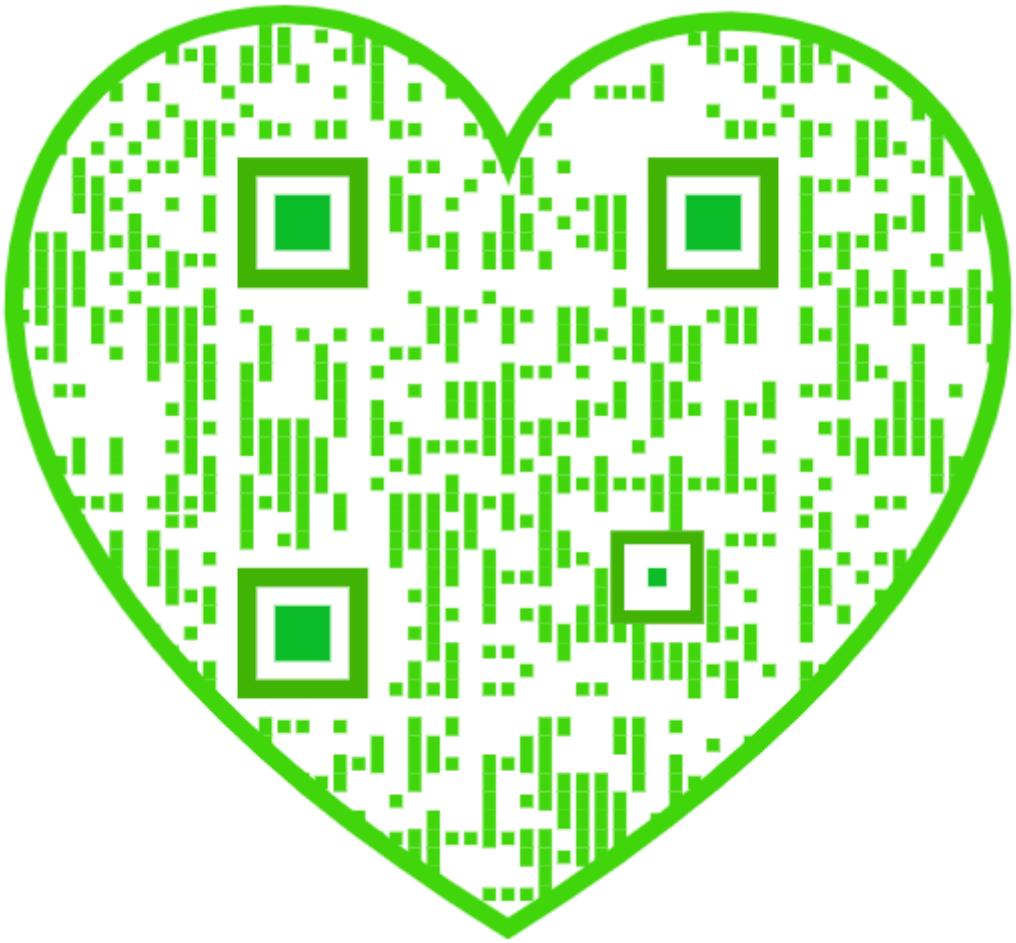

ject was treated largely from the physiological standpoint. In it he brought out the fact that muscular activity changed the chemical composition of muscular tissue. Later (1847) he proved that muscles in action produce heat.

In the same year he wrote his famous work on "The Conservation of Force," a work which was in line with Robert Mayer's earlier publications of 1842 and 1845, but which was written in ignorance of Mayer's investigations. This was before physicists had accurately distinguished force and energy and before J. Clerk Maxwell had worked up the theory of dimensions of physical quantities. The new doctrine, which was so near an approach to the truth, was enthusiastically received. Faraday, feeling its inconsistencies, bowed to authority and accepted it. Later, when the doctrine was changed to "The Conservation of Energy," all difficulty disappeared, and it is now universally accepted.

He was about this time professor of anatomy in the Berlin Academy of Art and next received the chair of physiology and general pathology in Konigsberg. He applied direct experimentation to the problems of animal life and examined the rate of transmission of nerve impulses and the duration of muscular contractions. This was in 1850. He finally determined that the nerves telegraphed their signals at about the speed of an express train (26·4 meters)—far slower than the velocity of sound.

In 1851 he described the ophthalmoscope. This instrument opened the "windows of the soul" to everyday inspection, and the dark chamber of the eye is now every day explored by its aid for the treatment of the maladies of sight. This invention alone was enough to make the reputation of a life. He followed this achievement by investigations in physiological optics, and his great work on the subject, "Text Book of Physiological Optics," published in 1867, represents ten years of work He was professor of anatomy and physiology at Bonn, 1855-1858, then he went to Heidelberg as professor of physiology. In 1862 his famous work on "The Doctrine of Tone Sensations as a Physiological Basis of the Theory of Music," was published at Brunswig, the third edition appearing in 1870. This was an epoch-making work. The true nature of sounds, the relations of fundamental notes and overtones in the production of vowel sounds, the physical analysis of sound and reproduction of the same by physical means, were treated by Helmholtz by methods and processes which laid the foundation of the science of acoustics. He also tried to find a basis for the action of the ear in harmonic vibration of its membrane. How far the ear can be accepted as a string instrument is, however, as yet a matter open to speculation.

His principal work in the realm of pure physics up to this period was these investigations on sound. Electricity and hydrodynamics occupied his attention after his acceptance of the professorship of physics in the University of Berlin, where he succeeded Magnus, who died in 1871. He applied experimentation to the investigation of the modern ether theory of electricity with signal success. Perceiving the analogy between vortex motions in fluids and electro-magnetism, he founded a mass of theory on the analogies, which has now been assimilated by modern physics of electricity. His work in electricity and the standing awarded him in it by electricians have given him a position in the electric world comparable to that which he holds in physiological science. His recent visit to this country, to attend the electric congress at the Columbian World's Fair, emphasized this fact.

into the laws of rain formation, of lightning discharge, of tides and of waves being classic.

In 1887 he accepted the presidency of the physical-technical institution in Berlin founded by the German Emperor, on the basis of a gift of one-half million marks (about $125,000) by Werner Siemens, at the same time taking the directorship of one section, the pure science department. In 1883 hereditary nobility was conferred upon him by the German Emperor.

It is futile to attempt within the limits of our space to give more than a mere skeleton of his work. His publications embrace not far from one hundred titles; some of them most abstruse, others so popular and interesting as to be veritable classics.

Aluminum Horseshoes.

Recent tests made in Arizona of aluminum horseshoes indicate that while the shoe, so far as perfected, will not wear quite a month when subjected to the severe mountain scouting in that section, Lieut. R. B. Wallace, 2d Cavalry, who made the test, found that the front shoes lasted some 28 days (306 miles) and the hind shoes 23 days (260 miles), through country covered with lava rock. As the country traversed was unusually rough even for Arizona this test may be taken as a fair indication that steel-clad aluminum shoes will answer all ordinary requirements of the cavalry service. These shoes have particles of highly tempered steel pressed into the sole of the shoe by a pressure of some 100 tons, which makes the wearing surface practically steel-clad.

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ASTRONOMICAL.

When unusual opportunities present themselves to astronomers for viewing certain objects or phenomena, and these events are commented on by the press, and brought to public notice by lectures, and in other ways, those who have never before given astronomical subjects a thought begin to look with purpose and a new interest at the heavenly bodies, while some such observers, almost before they know it, become habitual star gazers, and not a few look about them for some means of seeing more than the unaided vision will reveal. They press into service an opera glass, field glass, or, if available, a small army telescope, or telescope of larger dimensions, taking such works as Serviss' admirable book "Astronomy with an Opera Glass," Noble's "Hours with a Three Inch Telescope," Gibson's "Amateur Telescopist's Hand Book," Proctor's "Half Hours with a Telescope," or the charming book of Webb's, entitled "Objects for the Common Telescope," as a guide. They begin to make observations without any special knowledge of the objects viewed. The earliest lesson learned is that the hands make a very poor support for an optical instrument, and the first impulse is to secure some means of holding the instrument steadily, especially if it be one more powerful than an opera glass. After overcoming this difficulty, the next trouble arises from preconceived notions of magnification. When the telescope is directed toward a star, the star appears smaller than it does to the unaided eye, and when the moon is viewed through a telescope, it is with some disappointment at first, as regards size, because ideas of the size of the moon as seen with the naked eye are extravagant and erroneous; but let the observer view the moon with both eyes, with one through the telescope and the other without, and he will be able to superpose the image seen with the unaided eye upon that seen through the telescope. His ideas will then at once undergo a change, as, especially in the case of a small telescope magnifying fifteen or twenty times, he will see the moon fifteen or twenty times larger in the telescope than outside of it. Now the question arises as to why the moon is magnified while the star was not. The fact is the star is so far distant that, although its size may be many times that of our sun, it becomes a mere point of light, which no optical aid at our command can magnify to such an extent as to cause it to appear in the telescope like a planetary disk, and the amateur may have the satisfaction of knowing that even the largest telescope cannot show star images any larger, although it will show them brighter, on account of the superior light-gathering power of the larger instrument. A view of one of the planets reveals a disk of appreciable size even in a small telescope.

A three inch telescope mounted on a convenient stand is a desirable instrument for the amateur. It is very portable, and shows many of the beauties of the heavens to very good advantage. Seen though such an instrument, the stars have much of interest for the amateur astronomer—their color, whether they are single, double or multiple. Some of the star groups are a constant source of delight, as seen with a low power. In a good telescope, large or small, a star appears as a very minute disk of light, with two or three fine diffraction rings around it. Opticians tell us that the appearance of a star as a disk with diffraction rings is due to a radical defect which exists in all refracting telescopes. According to the correct theory, a star, in a telescope of any size, should appear only as a point of light.

How different the appearance of one of the planets! With the magnification of 160, Saturn appears larger than the full moon, as seen with the unaided eye. Jupiter with the same power appears with twice the diameter of the full moon, and with the power of 80 a very little larger than the moon. These statements can be readily verified by looking at the planet and the moon simultaneously, as suggested in the case of the telescopic image of the moon, superposed on its own image, as seen with the unaided eye, the telescopic image of Saturn or Jupiter being superposed on the naked eye image of the moon.

The illusion as to the apparent size of the moon may be said to be a secondary illusion. Some compare the size of the moon at the horizon to that of a small carriage wheel, others to that of a dinner plate; in fact, every observer has his own standard of size, but no one ever measured the moon by actual comparison with any object near at hand, like a wheel or plate, without having the illusion dispelled. A dime held at arm's length will eclipse the moon.

The difficulty lies in comparing the moon with objects at or near the horizon, which themselves being familiar are mentally recognized as appearing of the same size as they would if near by. A fairly tall chimney a quarter of a mile away when compared with a chimney across the street is less in height than three of the bricks of the near-by chimney; in fact, it might be said, as a rough approximation, that the distant chimney subtends a smaller angle of vision than would one of the bricks of which it is composed when placed across the street.

The observer says, perhaps, that the moon is larger

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than the chimney; but how large is the chimney? The illusion begins with mistaken ideas of the object with which the moon is compared.

THE HEAVENS IN NOVEMBER.

The present month is notable in astronomical annals for the occurrence of a transit of Mercury across the disk of the sun on Saturday, the 10th. The United States are specially favored in this case, since the event occurs in the middle of the day, so that not only will every one have an opportunity to witness it, but our astronomers will be able to study it under the best of circumstances. In Europe only part of the transit will be seen. It will begin here about 10:55 A. M., eastern standard time, and end about 4:12 in the afternoon. The little planet will cross the sun from east to west, considerably north of the center of the disk. Some optical aid will be needed to see it. A strong field glass will probably suffice to show it as a minute black spot on the sun, but a telescope will do better. In any case, the eye must be carefully shielded with a piece of smoked or black glass. The safest and most comfortable way to view the transit with a telescope, unless proper solar eye-pieces are at hand, is to project the image of the sun through the telescope upon a sheet of white paper held a foot or more from the eye-piece. Those who watch the transit with powerful instruments will be particularly attentive to observe whether, as the planet passes on and off the disk, it exhibits a ring of light, such as that seen surrounding Venus in similar circumstances, and the presence of which would be clear evidence of the existence of an extensive atmosphere on Mercury. Any peculiarity in the appearance of the planet as it crosses the sun should be noted. This event also offers an opportunity to improve our knowledge of the motion of Mercury in its orbit, of which certain unexplained anomalies recently led Prof. Newcomb to suggest the possible existence of a ring of planetoids revolving around the sun between Mercury and Venus. This is the thirteenth and last transit of Mercury for the nineteenth century.

Mars will continue to be conspicuous during November, although it is now receding from the earth. In the middle of the month it crosses the meridian about 20 minutes before 10 P. M. Some of its so-called continents and seas are still visible with telescopes of moderate size, but its south polar snow cap, conspicuous last summer, has disappeared. Apparently it has been an exceptionally hot summer in the southern hemisphere of Mars.

As Mars sinks toward the west, Jupiter will be seen rising in the east, a little to the left and north of Orion. The contrast between the two planets is striking and beautiful, Mars being decidedly reddish in tone and Jupiter white. As the former loses in brightness the latter gains, and by the end of the month Jupiter will have become the undisputed sovereign of the evening skies. Already it is a marvelous object for the telescope, being more brilliantly belted than during its last opposition, and displaying an unwonted profusion of color. Jupiter is in Gemini, rising on the 15th at 7 o'clock in the evening, and crossing the meridian about a quarter before 3 A. M.

The moon will reach first quarter on the 5th at 10:16 A. M., being then near the middle of the constellation Capricornus. It becomes full moon in Aries on the 13th at 2:49 A. M., and attains last quarter in Leo at 9:08 P. M. on the 19th. The new moon of the month occurs on the 27th at 3:54 A. M. It is in apogee on the 4th, and in perigee on the 16th. It is perhaps not generally understood that between apogee and perigee, the moon sometimes changes its distance from the earth by more than 31,000 miles, and that when it is nearest to the earth its attractive force upon our planet is about one-quarter greater than when it is farthest away; the apparent size of the moon also changes to the same extent.

The moon will be near Mars on the night of the 10th, near Neptune on the 14th, and near Jupiter on the 15th. Neptune, which to a practical eye, with any good astronomical telescope exceeding two inches in aperture, looks different from a star (although it is a mere point with such a glass), may be found rather more than 8 degrees northeast of Aldebaran and under the fifth magnitude star Iota in Taurus. Saturn, Uranus and Venus are too near the sun for observation this month.

There are many interesting objects in the stellar heavens conveniently placed during the evenings in November. Among these may be mentioned the great Andromeda nebula, which is nearly overhead at 9 P. M. about the middle of the month. It will be found instructive to turn the telescope—a three inch will do—from this nebula to the still greater and quite different one in Orion, which will be seen not far above the eastern horizon at the same hour. By waiting an hour or two later the comparison may be more satisfactorily made, as Andromeda will then have passed away from the zenith and Orion will have risen out of the mists.

The wonderful variable Algol in Peresus will be found some twenty-odd degrees east of the Andromeda nebula. This star, as many readers know, after maintaining its light at the second magnitude for more than two days, suddenly begins to fade, and in the course of about four hours sinks nearly to the fourth magnitude. In a few minutes it brightens again, and within three or four hours resumes its original brilliance. The cause of these remarkable changes, which are very regular, is believed to be the existence of an immense dark body, almost as large as Algol itself, and about the size of the sun, revolving around Algol so close that the distance between their surfaces does not exceed 2,300,000 miles! They swing around their common center of gravity, Algol flying twenty-six miles and its mysterious companion fifty-five miles per second. There will be a minimum of Algol on the 24th at midnight, Eastern Standard time. By adding 2 days, 20 hours and 49 minutes, the time of the next minimum may be calculated, and from that the next, and so on. If the theory of the cause of Algol's changes is correct, what those who watch that star on the 24th of this month will really see is an eclipse of Algol. Just at midnight on that date the huge black companion, whatever it is, will be exactly between us and the star, shutting off two-thirds of the latter's light.

There are also some fine double and multiple stars well placed this month. The location of those mentioned may be found by the aid of Proctor's star atlas. One of the most beautiful is Gamma in Andromeda. A small telescope suffices for this object, showing with a magnifying power of 50 or 75 diameters two stars only ten seconds of arc apart, the larger golden yellow and the smaller deep blue. The small star is again double, but only such a glass as the Lick telescope can at present separate it. Another beautiful double star which crosses the meridian about 10 P. M. in the middle of the month is Alpha in Pisces. The components in this case are much closer than those of Gamma Andromedæ, being separated by a space of only three seconds. The larger star is green and the smaller blue. A telescope of at least three inches aperture should be used for this star. In Cassiopeia, also favorably situated, will be found the star Eta, which is double, one of the components being straw colored and the other purple. Their distance apart is five seconds, but the purple star is so small that it may be difficult to get a satisfactory view of it with a telescope less than three and one-half inches in aperture.

Many other splendid objects adorn these mid-autumn evenings, but further reference to them must be omitted for the present. GARRETT P. SERVISS.

SMALL CALIBER PROJECTILES.

The recent movement in favor of small caliber arms for use in war has been inspired by several causes. The saving of weight, so that the soldier could carry more cartridges, is an important one. The production of a higher initial velocity is also made possible by the establishment of a heavier powder charge per unit of weight of bullet. To maintain a high average velocity in the face of diminished cross-section the bullet has been greatly elongated, so as to be almost a short arrow. Then, as rapid rotation has to be given it by strong rifling, a steel or other hard metal jacket is put on the bullet to prevent deformation by the lands and grooves, and the problem seems solved. The high initial velocity diminishes in flight so slowly that a low trajectory has been the result, and with one exception the arm is a great improvement on its predecessors of double its caliber. This exception is the lateral deviation due to wind. The ratio of weight to longitudinal section is so unfavorable that it is found that the new bullets are blown to one side by a cross-component of wind.

The action of the wind on a bullet as it leaves the mouth of the barrel is comparable to that of gravity upon a body beginning to fall. The pressure on the side of the bullet represents a force resisted only by the inertia of the mass of the bullet. Of course as the bullet moves laterally the wind exerts less and less force upon it, but for a strong wind and for the first second or two the force is not far from constant.

The force of gravity will carry in value a falling body more than sixteen feet in the first second of its fall. Wind pressure in engineering calculations is taken at a maximum of thirty pounds per square foot. As one of the new bullets has a longitudinal area of about one half a square inch, such a wind pressure would act upon it even more energetically at the start than would gravity. Any strong wind would, it is clear, deflect it rapidly from its course. If rifle practice were carried on in the assumed thirty pound side wind pressure, then the lateral deviation at first would exceed the vertical.

Such an extraordinary condition practically would never occur. But the possibilities which the above figures suggest have been shown to be real, and in a recent trial the deviation due to wind has been found to be very great. While striving for a flat trajectory and for lightness, the effect of wind in producing lateral deviation has apparently been overlooked.

The wind pressure, as has been said, is resisted by the inertia of the bullet, which varies with its mass and weight. If the weight is increased, the deviation due to wind will be decreased. But to enable the lead to stand the strain to which it is subjected, it has been found necessary to use a jacket of metal lighter than lead, which makes the bullet still more subject to the action of wind than a pure lead projectile would be.

The high specific gravity of lead, 11·352–11·388, makes it available for small caliber projectiles. Were it possible to use some other metal still heavier, an important advance would be made in the direction of high average velocity as well as of diminished wind action. The very heavy metals are rare. Iridium (hammered) is over twice as heavy as lead. Platinum and gold have nearly as high specific gravity as iridium, and uranium and tungsten come next with specific gravities of 18·33 and 17·00 respectively.

A rather curious suggestion has been made to the effect that tungsten might be used for bullets and shot. This suggestion was based entirely on its high specific gravity without regard to its other qualities. It seems quite possible that were a demand created for it, it could be produced in quantities at reasonable rates. It is difficultly fusible, combustible and brittle. At least this is as far as the properties are known. But if made in commercial quantities by alloying or otherwise treating it, there would be a chance of modifying its disadvantageous properties so as to obtain the advantages due to its high specific gravity. Even now the jacketed bullet is a compound structure whose jacketing interferes with its efficiency. A jacket of tungsten or of uranium would increase its weight, while the present jacket diminishes it. It seems quite probable that a compound bullet of lead and one of these heavy metals could be made which would have considerable value in the present days of small caliber rifles.

Aluminum has attracted most attention from its lightness. Another St. Claire Deville, who would initiate the production of a heavy metal to replace lead where weight is the principal requisite, might exert his powers on the reduction of the ores of tungsten and uranium.

Planet Notes for November.

The following is from Popular Astronomy:

Mercury will be at inferior conjunction November 10, at 12 h. 34 m. P. M. central standard time. The declinations of sun and mercury differ by only 4′ 53″, so that the planet will be seen projected on the face of the sun. The transit will last a little over five hours, beginning at 9 h. 55 m. A. M. and ending at 3 h. 12 m. P. M. central time. [An illustration showing how to project the sun's image on a sheet of paper and watch the transit was given in the SCIENTIFIC AMERICAN of October 27.]

On the 11th, at 10 h. 21 m. A. M., Mercury will pass by Venus, only 8′ south of the latter. On the 27th, at 10 h. 58 m. A. M., Mercury will be at greatest elongation west from the sun, 20° 10′. He will be at greatest brilliancy as morning planet, November 26.

Venus will be at superior conjunction November 30, at 9 h. 17 m. A. M., being then directly behind the sun. She will not be in good position for observation during the month.

Mars has for some time been the most conspicuous object, save the moon, in the evening sky. He far outranks the first magnitude stars in brilliancy, appearing almost to have a disk visible to the naked eye. Having in October passed his point of nearest approach to the earth, he is still comparatively near and in very favorable position for observation by amateurs. He will be in conjunction with the moon, 3° south of the latter, November 9, at 12 h. 56 m. A. M. On the 22d he will reach the end of the westward loop in his apparent path among the stars and will then begin to move eastward.

Jupiter lights up the eastern half of the sky while Mars does the western. The two planets are nearly equal in brilliancy but quite different in color, the silvery hue of Jupiter contrasting strongly with the ruddy light of Mars. Jupiter is in good position for observation after midnight. He will be in conjunction with the moon November 16, at 4 h. 4 m. A. M.

Saturn and Uranus will be behind the sun during November.

Neptune may be observed all night, the best time being about midnight, when the planet is near the meridian. He is in Taurus, not far from the star *l*.

The Absorption of Odors by Milk.

Parville relates some interesting facts upon this subject. If a can of milk is placed near an open vessel containing turpentine, the smell of turpentine is soon communicated to the milk. The same result occurs as regards tobacco, paraffin, asafetida, camphor, and many other strong smelling substances. Milk should also be kept at a distance from every volatile substance, and milk which has stood in sick chambers should never be drunk. The power of milk to disguise the taste of drugs—as potassium iodide, opium, salicylate, etc.—is well known.

IT is said that the frigate bird can fly at the rate of 100 miles an hour and live in the air a week at a time without touching a roost.

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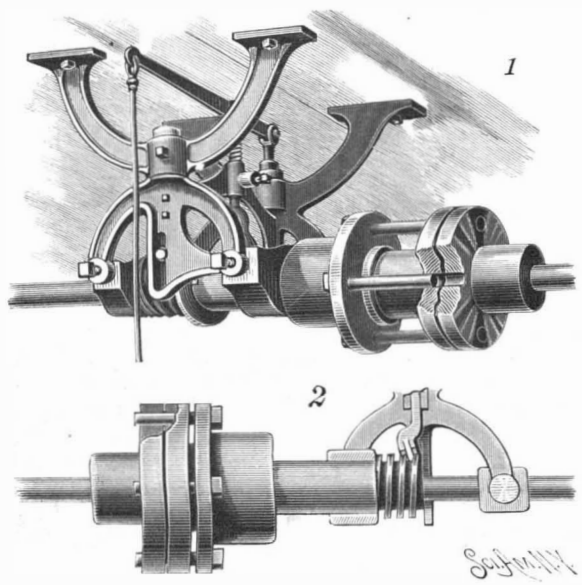
A CLUTCH TO COUPLE SECTIONS OF SHAFTING.

The clutch shown in the illustration is designed to hold the abutting ends of two sections of shafting so firmly together as to afford practically one continuous shaft, but one which may be instantly separated into two parts when necessary. The clutch is designed for most effective use in rolling mills, as the power comes direct from the engine. The improvement has been patented by Messrs. Thomas F. McGee and Eugene J. McCarty, of Clinton, Mass. Fig. 1 represents the application of the improvement, the sections of shafting uncoupled, and Fig. 2 is a partly sectional view, the

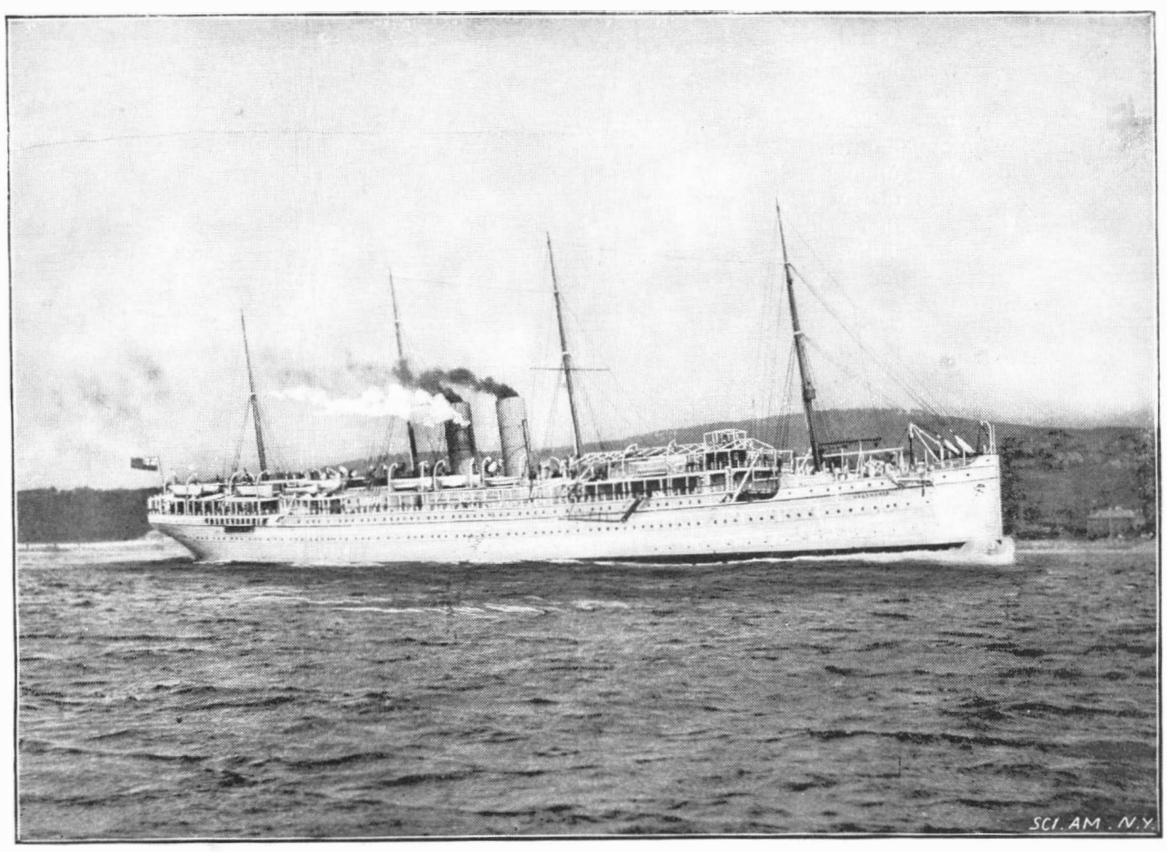


McGEE AND McCARTY'S CLUTCH COUPLING.

sections of shafting coupled. On one of the abutting shafts is a rigid flange with holes to receive coupling pins, which slide through holes in a flange on the opposing shaft, the pins being secured to a flange having a hollow hub sliding over the hub of the flange on the second shaft, and the hollow hub having at its outer end a sleeve terminating in a screw. The sleeve and shaft are supported in boxes in the lower end of brackets, at the upper ends of which are slides or shanks moving in boxes of the hangers, the brackets being held at the right height by set screws. The opposite brackets are connected by a cross arm, in which slides vertically the shank of the clutch blade, adapted to engage the screw, there being secured to the blade a curved guide extending beneath the screw, preventing the latter from working when the shaft sections are coupled. The clutch blade is held normally out of contact with the screw by a spring, and the upper end of its shank is pivoted to a transverse lever provided with a pull cord, which may be extended to such point as desired. In the box in which slides the shank of the clutch blade is a spring pin engaging a groove in the shank, whereby the blade is held in engagement with the screw when the pressure on the lever is removed. The clutch separates the two sections of shafting by power, but must be reset by hand. When the clutch is closed to hold the sections together, as shown in Fig. 2, the pulling down of the lever carries the clutch blade into engagement with the screw, thus pulling back the sleeve and movable flange to which the pins are secured, and withdrawing the pins from the flange on the opposing shaft.

THE NEW P. AND O. STEAMER CALEDONIA.

In a recent number of the Steamship we find a collotype engraving of the new steamer Caledonia, built by Messrs. Caird & Co., of Greenock, for the P. and O. Company. The Caledonia, built wholly of mild steel, and in accordance with Lloyd's highest requirements for a spar deck ship, was launched on the 19th May last, her construction having occupied a little under twelve months. The dimensions of the vessel are as follows: Length, 486 feet; breadth, 54 feet; depth, 37 feet 7 inches; displacement at load draught, 11,200 tons; and gross registered tonnage, 7,600 tons. She has been supplied with triple expansion engines of about 12,000 horse power, these having five cylinders—two high pressure, one intermediate, and two low pressure. The boilers are fitted with Howden's patent system of forced draught, the shafting throughout is of Vickers' steel, and the propeller is furnished with large manganese bronze blades. The deck machinery embraces all the latest and most approved appliances, and in this connection it may be stated that the cargo gearing is all hydraulic, practically noiseless in its working. The Caledonia is the largest vessel that has been built at Greenock, and is also the largest and most powerful yet constructed for the P. and O. Company. Not only so, but the rate of speed attained by the Caledonia during her official trials, on August 23, over the measured mile at Skelmorlie, goes to show that she will be one of the swiftest steamers engaged in the Eastern trade. There are five decks, viz., the orlop, lower, main, upper and hurricane, and a great attraction is the magnificent promenade on the upper deck, extending a long distance on both sides, and wide enough for eight or ten persons to walk abreast. She can carry 500 passengers (first and second class), the accommodation for whom is of a very superior kind. The staterooms are roomy, and are arranged in one, two or three berths, so that intending passengers can have ample choice. The ship is lighted throughout by electricity by Messrs. Siemens Brothers, Liverpool, and a large refrigerating chamber is fitted up, the machinery for which has been supplied by Messrs. Haslam, of Derby. Very superior accommodation is provided for the officers and crew, the latter numbering between 200 and 300, and of whom 114 are connected with the engine room staff. The Caledonia is commanded by Captain Andrews, R.N.R., an able and experienced officer.



THE NEW P. AND O. STEAMER CALEDONIA.

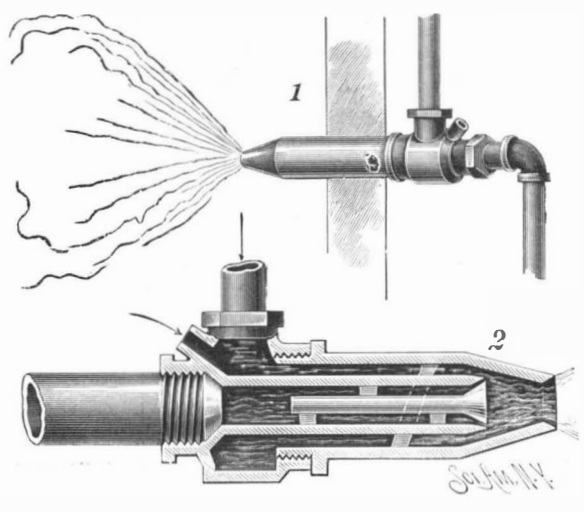
The Submarine Detector.

It is now a little over a year since the Russian monitor Rusalka foundered with all hands in a storm in the Gulf of Finland. To discover the precise locality of the vessel, with the view of raising her, an expedition set out with divers and all necessary apparatus, including one of Captain McEvoy's submarine detectors, which was made in London for the expedition. It has recently been ascertained that the spot where the Rusalka went down is a reef near the Waster Tokan, a rocky islet southwest of Mjolo, and one of the outermost rocks off the Finland coast. The reef is submerged, and it is supposed that the Rusalka grounded there and subsequently slipped off into the surrounding deep water. Her precise position has been localized in 30 fathoms of water by means of the detector. This apparatus consists simply of an electrical arrangement contained in a small mahogany box, which is carried on board the searching vessel, and a sinker, which is trailed along the bottom. The sinker also contains an electrical arrangement, and is connected with that in the box by a light electrical cable of any required length. When the sinker approaches a mass of steel, iron, or other metal, sounds become audible in a telephone on board, while they are reduced in intensity as the sinker recedes from the metallic object. Three hundred feet of electrical cable were employed in this search, which was continued for several weeks. The exact position of the foundered vessel was at length placed beyond all question, as every time the searching steamer passed over a given spot the electric indicator of the detector sounded loudly, thus affording evidence that a large mass of metal was submerged below. The divers then descended and examined the ship. She had foundered through serious damage to her stern. The examination was only external, the hatches being so firmly fixed that they could not be opened.

Although most appropriate for the purpose of searching for wrecks of iron ships, the submarine detector was primarily designed by Captain McEvoy to indicate the approach of iron ships to anchored torpedoes, as well as to search for stray torpedoes, lost anchors and chains, telegraph cables, and the like. The approach of a mass of metal, such as an enemy's ironclad, to a torpedo disturbs the balance and causes the sounds to become audible in the telephone. The torpedo may then be fired electrically by means of the cable connection, the invention thus presenting itself as an important adjunct of coast defense.

A BURNER TO FACILITATE THE BURNING OF CRUDE PETROLEUM.

In this burner, which has been patented by Mr. Berend Kamps, the oil inlet is at the top of the casing, there being an adjacent obliquely inclined air inlet, and below this a steam inlet, the nozzle having a contracted end extending into the furnace. The inner end of the steam inlet terminates in a pipe extending into the nozzle, as shown in Fig. 2, and near the front end of the pipe is a collar forming an annular space for oil within the casing around the pipe. The collar has a longitudinal slot or recess to permit the passage of the oil upon the front end of the steam pipe. In the forward end of the steam pipe is a cone-shaped plug, causing the steam to pass out at a high velocity



KAMPS' HYDROCARBON BURNER.

in a very fine annular spray, the plug having a rearwardly extending stem on which are lugs fitted in the steam pipe to hold the plug in proper position. Further information relative to the improvement may be obtained of the Zeeland Brick Company, Zeeland, Mich.

Improvements on the Danube.

A recently issued report by Mr. Percy Sanderson, British consul-general for Roumania, gives an interesting account of the improvements made in the navigation of the Lower Danube during the years 1878 to 1893 inclusive. The engineering works, which have been carried out under the able superintendence of Sir Charles Hartley, K.C.M.G., chief engineer to the Danube Commission, may be classed under three heads, viz., those on the Black Sea coast line, those in the port of Sulina, and those in the river. The approaches to the port have been made safe by beacons, as well as by fog signals and a "whistling" buoy, and the south pier at Sulina has been prolonged considerably. An even depth of 20½ feet has been maintained at the mouth of the river, and will be increased to 23½ feet by the completion next year of parallel dams. In the river numerous cuttings have been made, with the result that a minimum depth of 15 feet has been obtained on the whole of the Sulina branch of the river, while the course of the river has been shortened by six nautical miles.

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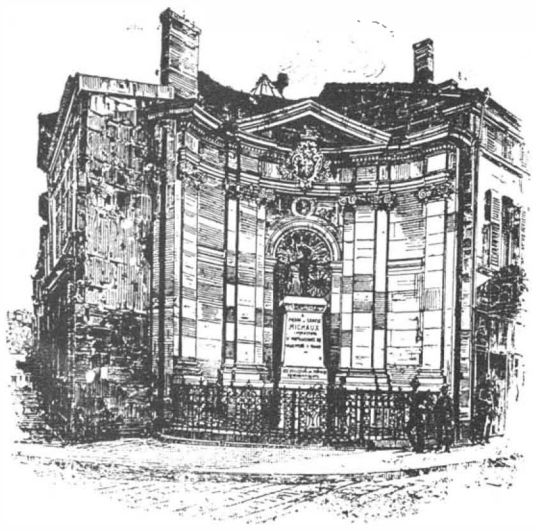
MONUMENT TO THE MEMORY OF THE INVENTOR OF THE BICYCLE PEDAL.

The velocipede was of comparatively little importance until a few years ago, but at present its use has become almost universal. This remarkable result has been due to the bicycle. This frail machine is used by turns for sporting, exercise, industrial and commercial purposes, and in war as well as peace. The popularity of bicycling in France is largely owing to the efforts of a popular paper, Le Petit Journal, which, since 1891, has not ceased to speak in favor of the exercise which was formerly disdained. In 1861 Pierre Michaux, aided by Ernest Michaux, applied the pedal to



THE MONUMENT TO THE MICHAUX BROTHERS.

the old velocipede, which was propelled by the action of the feet on the ground. Bicycles had then considerable success in the last years of the Empire. The war ruined both the Michaux, and France took little interest in the development of cycling until 1880, when the safety bicycle was put on the market. In 1892 a committee was formed, with M. Pierre Giffard as chairman, to honor the memory of Pierre and Ernest Michaux, who may be looked upon as the real initiators of the great movement in favor of cycling. In a year and a half several thousand francs were collected from cyclists, manufacturers and friends of the enterprise. As Pierre Michaux was born in Bar-le-Duc, the monument to the inventors of the bicycle pedal was erected at the intersection of two streets in that city. The architectural background for the work was designed by M. Demoget, while the charming bronze figure is a work by the sculptor Houssin. The inauguration of this monument took place Sunday, September 30, 1894. For the foregoing particulars and for our illustrations we are indebted to L'Illustration.

Ceramic Photographs.

The picture is on porcelain, or other vitreous ware, and japanned; that is, its surface when finished is as hard and durable as a good old-fashioned japanned tea tray, for example. As the images are produced by the carbon process, it goes without saying that they may be in any color that may be desired.

The process is carried out in the following manner: A carbon print is produced, preferably by the single transfer method, on the ware, which may be a porcelain plaque, a glass or metal plate, indeed upon any impervious material upon which a carbon print can be developed, and which will also withstand a considerable degree of heat. So far as the production of the carbon image is concerned, there is nothing different from the ordinary method of procedure; it is after this part of the work is completed that the novel portion of the process comes in. We will here digress for a moment to explain tersely what is known as japanning. This consists of coating the surface with a suitable varnish, in repeated thin layers, and then subjecting it for a time to a tolerably high temperature. The varnishes generally used for this class of work are amber and copal. The former yields, perhaps, the harder film; but the latter, if good, is little, if anything, inferior, while it is whiter, a consideration for our present purpose. It may be mentioned that it is not all amber or copal varnishes that are suitable for japanning. Those that must be used are what are specially prepared for "stoving." The varnish we have used very successfully was purchased under the name of "white dial varnish." It gave a colorless film, and was exceedingly hard and bright when the picture was finished.

Mention was just made as to the varnish being applied in successive thin coatings. They are put on with a camel's hair brush, but a fresh coating must not be applied until the previous one is thoroughly dry and hard, this condition being hastened by a moderate heat. If any brush marks are apparent, they may be disregarded, as they will disappear in the final stoving or in the after operation of polishing. After the work has been stoved, that is, kept at a temperature of from 150 degrees to 200 degrees Fah. for some hours, it is allowed to cool. The surface is then polished, first with pumice powder, then with tripoli and oil, and finally with putty powder, as lenses are polished. It will now be seen that the surface will possess an exceedingly high polish, and, if amber be the varnish used, it will be as hard and durable as the amber used for the mouthpieces of cigar holders and the like.

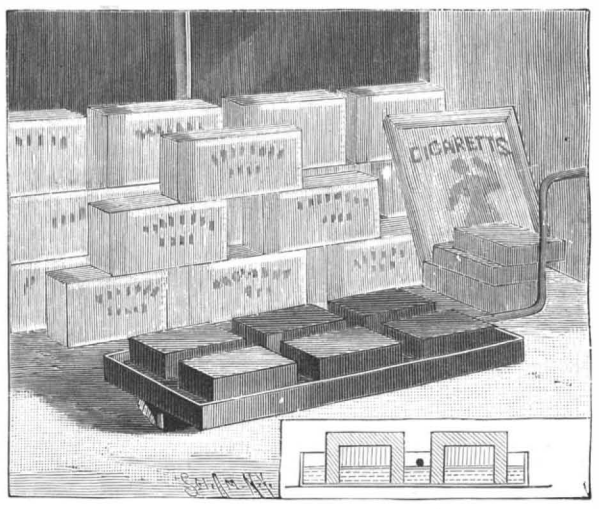
Here is the way we proceeded. The carbon print was developed on an opal plaque and allowed to dry. A thin coating of the white dial varnish was then laid on with a flat camel's hair brush. It may be mentioned that the varnish used for this coating was thinned with about an equal bulk of turpentine. Successive coatings were then applied, and finally the picture was stoved and polished as just described. The source of heat for the stoving in our experiments was the oven of the domestic kitchener, and it answered the purpose well, as the heat was perfectly under control.

In making pictures by this method it may be advisable to employ a tissue that contains a maximum of pigment and a minimum of gelatine, so that the film bearing the image is of a somewhat porous nature. The first coating of the varnish will then permeate it, and so bind it more firmly to the ceramic base. It is needless to mention that the pictures can be colored, if desired, before they are japanned.—British Journal.

THE MONUMENT ERECTED AT BAR-LE-DUC IN HONOR OF THE MICHAUX BROTHERS INVENTORS OF THE BICYCLE PEDAL.

A TOBACCO OR CIGAR MOISTENER.

The illustration represents an improvement designed to facilitate the moistening of the air in show cases, etc., in a more effective manner than by the use of sponges, as usually employed. It has been patented by Mr. Jay A. Robinson, of Denver, Col. The moistener consists of a rectangular hollow porous block, having an open bottom and with its lower edges roughened to permit the entrance of water. A number of these blocks are placed in a tray containing water, and the tray may, if desired, be connected with inlet and outlet pipes to maintain a constant supply of fresh water, although this will not be necessary for ordinary use. These blocks are designed to present a better appear-



ROBINSON'S TOBACCO OR CIGAR MOISTENER.

ance and be more conveniently attended to than sponges, while exposing a larger moist surface to the air.

The Causes of Epidemics.

In a lecture given recently to the Halifax Scientific Society, Dr. Solomon Smith drew attention to the fact that to produce an epidemic prevalence of any disease the co-operation of many causes was necessary. These factors might be grouped as:

1. Those which increased the susceptibility of individuals, about which we knew but little.

2. Those which favored the outside growth and development of the infection—heat, moisture, organic impurity of soil and water, aeration of soil, etc.

3. Those which favored the fouling of the water, floods or droughts, according to circumstances, varying level of subsoil water, construction of wells, tanks, and water supplies, their relation to cesspools, and surface pollutions, and social habits of the people by which such pollution was encouraged and carelessness as to drinking foul water induced.

4. Those by which the infection was transmitted from place to place, especially movements of large masses of people, as in pilgrimages and wars, and the rapid distribution of cholera-infected people over large areas in some part or other of which a suitable nidus for fresh growth of the infection would be likely to be found.

Cholera was, no doubt, continually being exported from its home in India; but it only occasionally became epidemic in those places where it was an exotic, and when this happened we must look for an explanation not merely to water carriage, which was the mere mechanism of its spread, but to a coincidence of those varied and complex causes which assisted in the intensification of the disease. To some extent the production of an epidemic was analogous to the opening of a "word" lock. As all the letters must be placed in position before the lock could be opened, so many factors must combine before an epidemic of cholera could be caused. The converse of this, however, was also true, and on this was founded our protection from cholera, for however little we might know with precision about some of the multiplex causes of a cholera epidemic, we did know that one essential cause, one letter to the lock, was the swallowing of the poison, and thus by a provision of pure water we were able to break up the combination by which alone an epidemic could be produced.—British Medical Journal.

Nitrate of Soda Freezer.

Instead of ice and salt, nitrate of ammonia is used. For a small ice cream freezer, 7 pounds of the nitrate and 3 quarts of water. The freezer is then rotated. The cream or water is quickly frozen if the material is first cooled down before applying the nitrate. The nitrate is recovered for reuse by evaporating the solution to dryness on the kitchen stove.

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Charles Ehrmann.

The death of Charles Ehrmann at the age of seventy-two, familiarly called Dr. Ehrmann by his photographic friends, occurred in this city on October 23. He was a man who took great interest in the art of photography, beginning its practice when first discovered. He was educated as a pharmaceutical chemist, taking a position as a prescription clerk in a Philadelphia drug store in the forties. There he met a Mr. McClees, who had opened a daguerreotype gallery, and was having trouble with his chemicals. He asked young Ehrmann if he knew anything about chemistry, he modestly replied in the affirmative and McClees engaged him at once. Ehrmann then began to experiment with the Whipple albumen process, which was very slow. He improved the method of coating the plates by mixing the citrate of iron and ammonia solution and albumen solutions together, and flowing over the plate as one solution. A daguerreotype from the person was made, then a negative from that by the albumen process, from which duplicate daugerreotypes were printed.

In 1852 he became acquainted with Mr. Ed. Thilgman, who had returned from Europe, having seen Mr. Archer, of Edinburgh, who was the first to introduce the collodion wet plate process.

He met with poor success in experimenting with this process, until the patent of James Cutting, of Boston, was issued providing a method of bromizing the collodion, which made it practical. Operators who became proficient in it earned large wages. For a long time Dr. Ehrmann was the chief operator and chemist of Mr. William Kurtz, a leading photographer in this city, and took portraits by the electric light in a down town office on Broadway. The camera and person were placed on a rotating platform, which was slowly swung around during the interval of exposure, thus inducing very soft shadows.

In 1881 he was taken on the editorial staff of the Photographic Times, of this city, as an assistant to J. Trail Taylor, and remained as one of the principal editors until his death. In 1886 he was appointed instructor in the school of photography established by the Chautauqua University, and won many friends by his genial nature and kindly manner. He took up the problems connected with emulsion photography and the modern gelatine plate in a practical, scientific, experimental manner, was deeply interested in the new developers, particularly praising paraamidophenol.

He was a very clear writer on the chemistry of photography, industrious and thorough. He believed there was an immense future for photography, and lived to see marvelous advances. He will be greatly missed, but his work will live to perpetuate his memory.

Compliment for "Experimental Science."

Dr. Frank L. James, editor of National Druggist, in response to the request of a physician to outline a course of reading for one who desires to begin the study of medicine, says in the course of his remarks:

In physics the best book to go into the hands of an intelligent beginner is "Experimental Science," by George M. Hopkins, published by Munn & Co., of the SCIENTIFIC AMERICAN. Mr. Hopkins has, in this work, made the study of physics almost as interesting and entertaining to a healthy boy or young man as base-ball or cycling. He illustrates principles by experiments, and these latter are made so simple, by careful description and profuse and accurately drawn pictures, that they can be executed by any person with the least ingenuity. The work covers a wide field, and will introduce you to chemistry, microscopy, and other allied sciences. Even if you have studied physics as taught in the high schools, you will find it a most admirable book, one that will be of great use to you in advanced studies.

Torrefied Pulp.

A new method of preparing and preserving potatoes to be fed to cattle or to be made the basis of dishes for the table has been devised by M. Aime Girard, of the Conservatoire des Arts et Metiers, Paris. The potatoes having been ground, the pulp is exposed to pressure for the exclusion of all the water that can be removed by mechanical means. The pulp is then sliced and heated in a furnace till it is entirely dried, at a temperature high enough to give it a pleasant taste, without being so high as to convert the starch into dextrin. The substance thus prepared is called by the inventor torrefied pulp, and is suitable for feeding to cattle.

PICTET finds that where powdered sulphide of lime —the material used in the so-called "luminous paint" —was placed in a tube, it glowed as usual in the dark after exposure to the sun's rays, but when the tube was lowered into liquid nitrous oxide at —140° F., the glow was quenched. The phosphorescence did not reappear at once when the tube was removed from the cold liquid, but it returned when the sulphide had become heated again.

Artificial Marble.

Messrs. Majewsky & Bayenbach have recently patented a process of manufacturing artificial marble from gypsum. The method of treatment, according to Le Genie Civil, is as follows:

The gypsum is first worked with the plane, saw, or lathe to the desired form and is then heated in a furnace for from seven to nine hours, in order to get rid of the water of crystallization. The dehydrated material is then immersed for a few minutes in a saturated solution of sulphite of potassium and afterward in a solution of chrome alum, sulphate of iron, or sulphate of zinc or magnesia, according to the color that it is desired to obtain. At the end of about twenty-four hours it is removed from the bath and allowed to dry in the open air for one or two days. It is then ready to receive a polish.

The object of the treatment with sulphite of potassium is to facilitate the complete impregnation of the gypsum with the substances employed for producing the coloration, in the production of which it plays a direct important part, itself becoming oxidized at the expense of the coloring materials. It forms sulphate of potassa. At the same time it removes from the coloring solutions the oxides of the metals to which the particular color of the finished product is due.

During the course of drying the solutions with which the gypsum is permeated crystallize in the pores of the material, and, filling them, form a solid and impermeable mass.

If the piece of gypsum is of considerable thickness, the complete impregnation of the mass is assured by forming longitudinal apertures and sucking out the air while the material is immersed in the solutions.

Aluminum not Suitable for Boats.

The Navy Department has just completed a test of aluminum as a material for ship boats, with the object of determining its adaptability to naval uses, with results that demolish some of the elaborate claims made for the new metal.

On account of its comparatively light weight, its utility on board ship would be almost inestimable if it were not for the fact that it has been now shown to be exceedingly susceptible to the corrosive action of salt water.

Two sheets, one-sixteenth of an inch thick, were immersed for three months at the Norfolk navy yard. One was of pure metal and the other slightly alloyed with nickel. The pure plate was thickly covered with large barnacles throughout its surface and was more or less pitted by the action of salt water. The alloyed plate was incrusted with smaller barnacles and was badly corroded, being perforated and eaten away over much of its exposed surface. This plate was as injuriously affected as a combination of iron and copper would have been with the same exposure.

The claim that barnacles would not adhere to the metal was not substantiated in the smallest degree.

In the opinion of naval experts it will not be advisable to build aluminum boats if they are intended to remain any length of time in the water, though its use may be advantageous on account of the great gain in lightness for metal work exposed to salt water only occasionally. The use of aluminum cannot be recommended near salt water under any circumstances.

Eyes and Eye Doctors.

In no branch of surgical science has more progress been made of late years than in that which concerns itself with the eye. Within the memory of men now living persons with defective vision were divided into myops or short-sighted people and hypermetrops or long-sighted people, and for the former concave spectacles were devised which threw the focus of vision back, while for the latter convex spectacles brought the focus in front of the retina. It was assumed that the only differences in these two forms of visual disturbance were differences of degree, and when the half-blind person could by a violent effort read through the spectacles which the optician tendered him he was supposed to have got all the relief which science could furnish him. Science has now done for the eye what specialists are trying to do for the nerves. It has diagnosed a variety of ailments which were unknown to our fathers, and for these it is busily engaged in devising remedies. The human eye, when studied under the microscope and in accordance with the laws of optics, is found to be one of the most imperfect organs in the body. There are few perfect eyes in the world. The refracting surfaces are constantly curved so as to blur the image, and to produce what doctors call astigmatism. There are frequently opacities in the transparent media, which cast a shadow on the retina and distort the vision. Sometimes the retina acts like a lens and disperses the various pencils which constitute white light. These and other defects can be detected by the modern oculist, and treated by the knife or counteracted by suitable glasses. But it is plain that this is work for which the skill of the oculist is required and which cannot be intrusted to an optician, however well trained he may be. A learned German named Helmholtz some years ago invented an instrument called the ophthalmoscope. With this instrument the structure of the eye can be determined at leisure and its departures from the normal detected. The oculist then goes to work and devises a pair of glasses with just the curves required to correct the defects of the eye; these glasses, described in mathematical symbols, are handed to the patient as a prescription to be filled by a competent optician. There are in European and Eastern cities opticians who do nothing but fill such prescriptions. They work over glasses as Alvan Clark works over telescope lenses; the curves must be mathematically true or the glasses will not fulfill their purpose. But when the mechanic knows his business, and the work is done according to the prescription, the defects of the eye are cured.—San Francisco Call.

Western Union Annual Report.

The annual report of the Western Union Telegraph Company for the year ending June 30, 1894, shows that as compared with 1893 there was a decrease in the revenues of $3,125,787. There was a reduction in the expenses of $1,422,235, leaving the net profits lower by $1,703,733 than in the previous year. The company constructed during the year over 1,300 miles of new pole line and nearly 22,000 miles of new wire, but lines taken down reduced the net increase of pole line to 367 miles; while the net increase of wire was reduced to 21,591 miles. More than half of this is copper; the cost for these additions to the property amounting to $557,021.64.

The average toll per message was 30·5 cents, and the average cost per message 23·3 cents. The higher cost per message is due to the general depression of business and the impracticability of reducing expenses at the many smaller offices beyond a standard that would provide for the proper handling of the messages. The largest amount expended during the year was for wages. It was found possible to so arrange the hours of duty of the employes of the company at the larger offices as to give each one a fair share of the reduced work at command without materially reducing the number employed. Since the expiration of the fiscal year the system of the American Rapid Telegraph Company, which comprised 2,684 miles of poles and 20,370 miles of wire, extending east to Boston, south to Washington and west to Chicago, has been purchased for $550,000 in Western Union stock at par. The company has also purchased since the close of the fiscal year 10,000 miles of copper wire, which will be erected before January 1 on important trunk routes. A five per cent dividend was declared.

The Last of the Buffaloes.

Hunters know that buffaloes will never unless forced cross the iron of a railroad track, and this fact figured largely in the unfortunate work of extermination which these animals have suffered since the Western plains have been spanned by railroads.

The greatest blow dealt the bison herds of the Northwest was the completion of the Northern Pacific track west from Bismarck to the Rocky Mountains. The road practically divided the herds, and those to the south were soon swallowed up in the general slaughter waged by Indians, pot, hide and tongue hunters, foreign sportsmen and others who were out to kill anything they saw on sight.

This was during the winter of 1882-83. The buffaloes to the north were in many scattered bands, but there was one great herd of not less than 75,000 head, which had found a temporary refuge in the triangle formed by the Musselshell, Missouri and Yellowstone rivers in Montana, and as yet they had not been "smelled out" by either red or white hunters. But they were as surely doomed as though already killed, for the railroad iron cut them off from the southern range, and the Indians of the Canadian northwest, as well as those of our country, barred their retreat into the far North, and so they were hemmed in between the two, with no possibility of escape in either direction. This last herd was completely wiped out of existence in less than four months, and before the close of the year there were but a few singles and pairs left as fugitives in that vast country where but a year or two before they could have been counted almost by the hundreds of thousands. At the end of that season 800,000 buffalo hides were shipped east from Glendive, on the Yellowstone River.

Increasing Demand for Otto Gas Engines.

Contracts have just been given out for the erection of several large additional buildings to extend the facilities of the Otto gas engine works in Philadelphia. The company are now also building marine engines in sizes from 2 to 250 horse power, plans of which have been received from the Otto works in Germany, which have a capacity of from 2,500 to 3,000 engines per year. The latter type of machines will also be adapted to the use of running dynamos for electric lighting direct from the engine.

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Correspondence.

The Hut-building Cicada.

To the Editor of the SCIENTIFIC AMERICAN.

I was much interested in the article which you published in your issue of October 13 on the "Hut-building of the Seventeen Year Cicada," by Mr. Lander. I think he is on the right track to a solution of the problem by agitating the matter, but I can hardly agree with him in his explanation.

According to my experience, he is quite right in not regarding the seventeen year cicada as a migrating insect; but it seems to me that the lack of this trait will not and, in fact, has not prevented it from spreading over a large extent of country. It must have had some means, or may be many means, of being transported from one place to another. Whether the transportation is intended or purely accidental I cannot say. It seems to me that there are many ways that the insect can be spread over the country, the extent of the dispersion depending only on time. In support of this view I will state the following instance:

On Decoration Day I took a long drive about the country in which my home is situated. I drove about 30 miles through all sorts of country; in some places the seventeen year cicada was plentiful, in others scarce, and in many places was not to be seen at all. During the course of the drive I stopped on top of the Watchung Hills, at a point about 400 feet above the sea level and perfectly dry; that is, it was not swamp land. As I was putting blankets on the horses I noticed a seventeen year cicada on the back of one of them. I picked it off and observed that it was a female and then let it go. I thought nothing more about it until I read Mr. Lander's article, then the thought came to me that if that female had been a hut-builder from some lowland, then, according to Prof. Riley's theory, there would be mud huts on top of that hill for the next few generations anyway. How long it would take the trait to die out I am not able to say.

We have stories of their getting on railroad trains. In this way they could be carried quite a distance before the train would be clear of them. So it seems to me that the hut-builders could very easily be carried from low to high land in one way or another.

I do not think it possible for the earth to become in a few weeks so warm from the solar heat rays that any creature living in the earth would be forced to come to the surface; which action I think would only make the matter worse, by reason of its getting into much warmer strata. In the case of the hut-building pupæ, it seems to me that they could do nothing worse than to build such a hut. It would be out of the frying pan and into the fire, as the old saying goes. Dr. Southwick gave me some huts which he collected at New Baltimore, N. Y., they were hard and dry, having the appearance of sun dried clay. Surely the pupa would find it much warmer in such a position than it would below the surface.

The hut receives the heat rays on all sides. It would also receive a great deal of heat by radiation from surrounding ground.

I offer as an explanation of this matter, that the pupæ build these huts to receive heat instead of avoiding it, and that this habit has been developed by those who happened to emerge in wet places where the earth could not become as warm as in dry places.

That these hut-building insects have been in various ways transported to high ground, and have not yet lost the hut-building trait—this I believe is practically Prof. Riley's explanation of the matter.

STEPHEN A. KROM.

Plainfield, N. J., October 24, 1894.

Homemade Beef Powder.

Dr. William R. Huggard (Davos Platz, Switzerland) writes in the British Medical Journal of June 9, 1894: Some of the beef powders in the market smell and taste of the chemist's shop, and are not readily taken by an invalid whose palate requires to be coaxed. A happy idea struck the writer several months ago that beef powder might without difficulty be prepared fresh and on a small scale by any ordinary cook. The experiment was made, and the result was satisfactory beyond expectation. Beef powder made at home is appetizing, has a delicate aroma and flavor, and can be taken with pleasure by invalids who turn with aversion from ordinary food. If a little pepsin be taken at the same time, it is digested even when the ordinary peptonized foods are not retained. The mode of preparation is simple. Lean beef is cut into small pieces; these are put into boiling fat, dripping, or butter for a couple of minutes until the surface is browned. They are then removed from the fat and placed on a strainer for a few moments. Afterward they are placed in a mincing machine. The resulting mince is placed in a slow oven and dried. The drying process may take from five to twenty-four hours, or even longer, according to the heat employed. When thoroughly dried, the meat is quite crisp, and can be ground in a coffee mill that has not been used for any other purpose. In the drying process the meat loses a trifle more than four-fifths of its weight. This beef powder can be taken in various ways—with hot water or soup, with mashed potatoes, with bread and butter in a sandwich, or with a little pepsin in a starch wafer. The writer has given this homemade beef powder with such excellent effect in several cases where there was much difficulty with food that he thinks others may find it useful.

Beef powder, carefully prepared according to the directions above given, has an agreeable flavor, and admits of being used like potted meat by persons of delicate or fanciful appetite. By regulating the heat applied in making the powder, the albuminous constituents need not be coagulated, but merely dried, and the digestibility of the powder would then be increased; in any case, the finely divided condition would facilitate digestion. A very good beef tea may be made from the powder by infusing it in moderately hot water. For the preservation of the powder it would be necessary to keep it from contact with atmospheric air and to avoid the access of mites or similar deteriorating influences.

Natural History Notes.

Fountain Trees.—Mr. Duchartre recently made known to the French Academy of Sciences the results of an experiment made by Mr. Maxime Lecompte in Congo upon a tree of the genus Musenga. Upon making incisions in the trunk of it and placing a pail at the foot of the tree more than ten quarts of pure water were collected in thirteen hours. The gorillas, it seems, are in the habit of slaking their thirst at these hidden fountains, and regulate the flow of the liquid at will by pulling off different sized branches.

Many years ago, Dr. Wallich found in the province of Martaban, Africa, a plant belonging to the same natural order, whose soft and porous wood discharged, when wounded, a very large quantity of a pure and tasteless fluid, which was quite wholesome and was used as a beverage by the natives. This plant was named by Dr. Wallich the water vine, and has been placed in the genus Phytocrene, which signifies "plant fountain."

These plants form a remarkable exception to the usual character of the order, which embraces species that produce a milky juice, such, for example, as the celebrated cow tree, or Palo de Vaca of South America, which yields a copious supply of a rich and wholesome milk, as good as that of the cow, and used for the same purposes.

The Exploits of Diving Birds.—Engineers have often announced that submarine vessels would some day acquire a speed much greater than that of ordinary ships. The diving birds furnish us with a powerful argument in support of this opinion, for they move with surprising rapidity under water. The penguin, for example, can neither fly nor walk, but hops along as if its legs were tied together. Nor does it swim, for it literally flies under water. When, at the Zoological Garden of London, the keeper brings food to these birds, a sudden transformation is witnessed. The bird, which is heavy and awkward, suddenly becomes a superb and rapid creature, covered with globules of silver formed by the air imprisoned in its plumage, and flying in the depths of the placid water with a rapidity of evolution that is unknown in aerial flight. The motion of its wings is identical with that of ordinary flight, and its feet, extended in a line with its body, serve neither as motors nor as rudders. Steering is effected through the acceleration of the motion of one of the wings at the expense of the other. The fish thus chased is captured and swallowed without any retardation of the speed of the bird being visible. The cormorant, on the contrary, swims with his feet, which act like the paddle boards of the wheel of a steamboat. Yet the conditions of the submarine medium are so exceptionally favorable that the speed obtained therein by the cormorant is three or four times greater than that which it makes upon the surface.

Intercellular Communication in Lichens.—Mr. G. Poirault has found in the thallus and apothecia of lichens indications of very minute channels in the cell walls, permitting of the intercommunication of the cell contents, the protoplasm communicating through the perforations in the membrane. Fresh material is not necessary for the examination, and previous fixation of the protoplasm is not required, as in the case of the phanerogams. In Usnea barbata communication is said to exist between distant elements, as well as between adjoining cells. Other species in which similar phenomena have been observed are Cladonia rangiferina, Peltigera canina, and Calicium chrysocephalum. It is proposed to illustrate these peculiarities of structure in a subsequent note.

Classification of Plant Tissues.—Recent attempts to found an internal morphology of plants have given a new life to the study of botany.

The recent progress in this direction is mainly due to Van Tieghem, the French botanist, the characteristic feature of whose anatomical teaching is the recognition of the central cylinder or "stele," as a definite region comparable to cortex and epidermis. In the root the central cylinder is perfectly well defined, including within it the ring of alternating bundles of wood and bast, accompanied by a certain amount of parenchyma (conjunctive tissue), the outer layer of which constitutes the pericycle, or limiting layer of the stele. The cortex, the inner layer of which is the endodermis, surrounds the stele, and outside the cortex is the piliferous layer or epidermis.

The same three regions—central cylinder, cortex, and epidermis—exist in the stem. The stele is made up of the vascular bundles and conjunctive tissue, the latter constituting the pith, primary medullary rays, and pericycle. The last named is often less obvious than in the root, but is characterized by the same power of forming new tissues and organs. At every node the continuity of the main stele is interrupted, and its limits may be difficult to recognize, but it is none the less a distinct region in the stem because it possesses prolongations into the leaves. Where the vascular bundles bend out from the stem into the leaf, they are accompanied by conjunctive tissue, and the name "meristele" is applied by Van Tieghem to such a bundle or group of bundles entering a leaf, with their enveloping conjunctive tissue. Thus the stele tissue of the whole plant is seen to be continuous through all its organs—root, stem, and leaf.

In the typical stems of phanerogams there is a single central cylinder in direct continuation with that of the main root. This "monostelic" condition is constant in the embryonic stem of all vascular plants. But in many vascular cryptogams and in the genera Gunnera and Primula, section Auricula, the cylinder divides up above the hypocotyl or first stage of the stem, a number of equivalent steles thus resulting. In most ferns, and in many selaginellas, this "polystely" occurs.

"Astely," or "schizostely," is a departure from typical structure characterized by the stele completely breaking up into the individual bundles, each surrounded by its own "peridesm" (the conjunctive tissue at the periphery of any portion of a subdivided stele, as distinguished from the pericycle which surrounds an entire stele) and endodermis. Typical examples occur in Equisetum limosum and other species, in Nymphæa and aquatic species of Ranunculus, etc.

Change of Color in the Hare.—From a study of seventy-five specimens of the northern hare or white rabbit (Lepus americanus, Erxl.), collected for the purpose of investigating the spring and autumn change of color, Mr. J. A. Allen reaches the following conclusions:

1. The change of color, both in autumn and in the spring, is due to change of pelage, and not to a change in the hair itself.
2. The change is gradual, occupying many weeks.
3. The method of change, as regards the parts first affected, is the reverse in spring in the order characterizing the autumnal change.
4. In the early part of spring, after the white overhair has been shed, the pelage consists of the heavy coat of soft winter underfur. This gradually disappears as the summer coat thickens.
5. In spring the moult occurs quite as early and proceeds just as rapidly in the females as in the males, and the moult is practically completed before the young are born.

These conclusions differ widely from views hitherto entertained by both scientific and non scientific writers.

Foothold on Pavements.

Some little time ago officers of metropolitan police were deputed to make certain observations concerning road traffic generally during the discharge of their daily duty in the busiest thoroughfares. These observations extended over fifty days of twelve hours each day, namely, from 8 A. M. to 8 P. M., and granite, asphalt, and wood pavement were considered. In one day of twelve hours no fewer than 12,366 horses and vehicles passed along Cheapside, and 5,350 along Cannon Street. During the fifty days upon which observations were taken, 542 accidents took place on wood pavement, 719 on granite, and 1,066 on asphalt. From these figures it was estimated by an expert that a horse could travel 330 miles on wood pavement during the fifty days without meeting with an accident, 191 on granite, and 132 on asphalt; therefore the great superiority of wood pavement over all others—at least, where horses are concerned—is at once apparent. Altogether, 1,054 falls were recorded, and an analysis of this number (London says) affords some curious information. On asphalt, 247 partial and 190 complete falls took place; on wood 326—only 39 complete falls. Roughly, for every fall on wood pavement four took place on granite and asphalt.

An Atom of Electricity.

According to a recent determination of Professor Richarz, the smallest possible quantity of electricity, which may be termed an atom of electricity, is such that 430 multiplied by a million three times, that is, by the cube of a million, will give the number of these atoms contained in a coulomb. That such a thing as an atom of electricity exists is the opinion of no less an authority than Professor Von Helmholtz.

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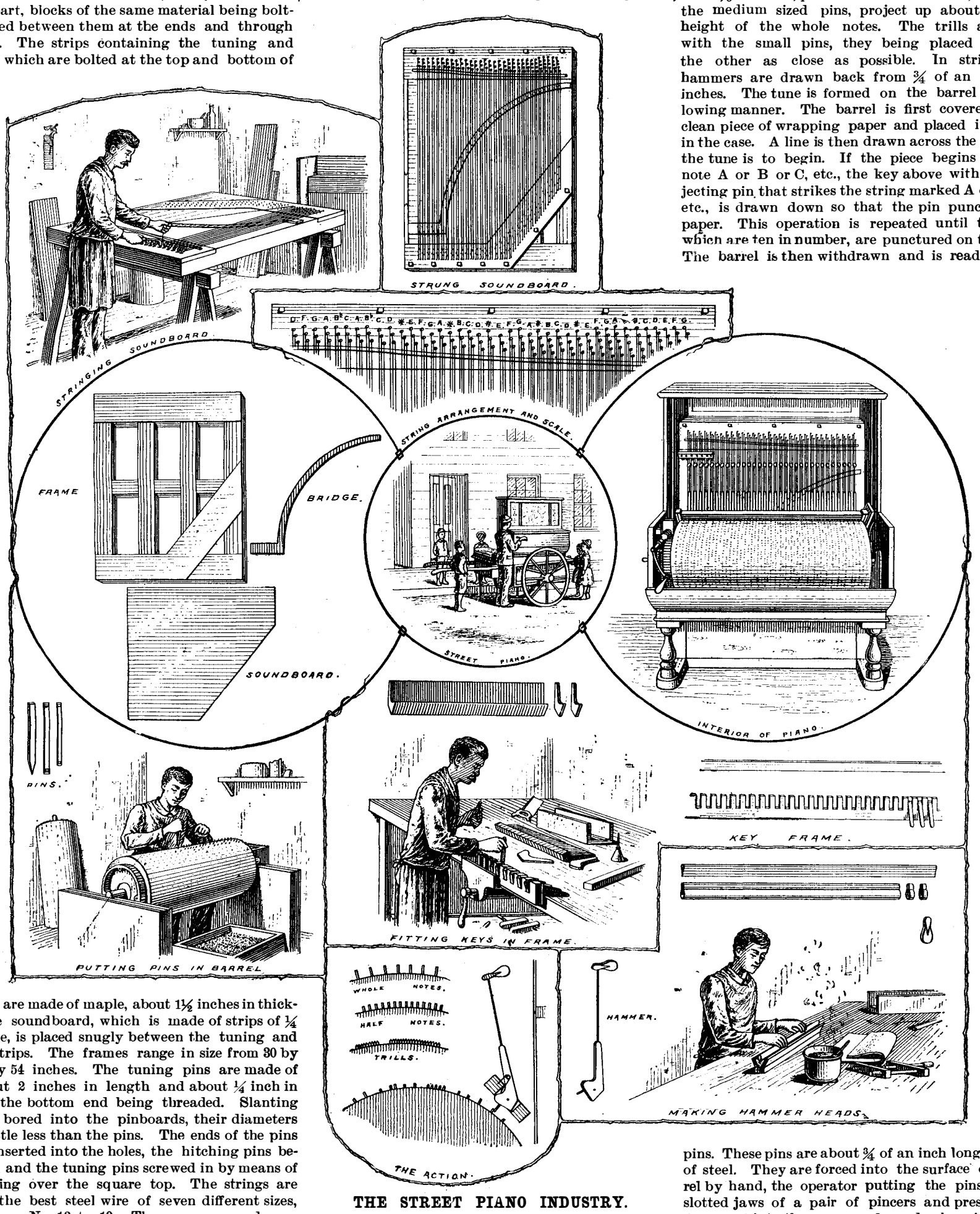
STREET PIANO INDUSTRY.

The handle or street piano was first manufactured in Torino, Italy. They are used principally by Italians, who push them around the streets in two-wheeled carts or wagonettes, stopping from house to house, grinding out the popular airs of the day. A great many are now in use as parlor instruments. The construction of the soundboard of these pianos is similar to those used in our upright pianos, the framework in the street instrument being made of wood instead of iron. The frame over which the soundboard and strings are placed is made of strips of thoroughly seasoned pine. These strips are about 2½ inches in width, about 5 inches in thickness, and placed about 6 inches apart, blocks of the same material being bolted and glued between them at the ends and through the center. The strips containing the tuning and hitch pins, which are bolted at the top and bottom of the frame, are made of maple, about 1½ inches in thickness. The soundboard, which is made of strips of ¼ inch spruce, is placed snugly between the tuning and hitching strips. The frames range in size from 30 by 44 to 42 by 54 inches. The tuning pins are made of steel, about 2 inches in length and about ¼ inch in diameter, the bottom end being threaded. Slanting holes are bored into the pinboards, their diameters being a little less than the pins. The ends of the pins are then inserted into the holes, the hitching pins being driven and the tuning pins screwed in by means of a key fitting over the square top. The strings are made of the best steel wire of seven different sizes, ranging from No. 13 to 19. They are arranged over the soundboard containing the bridge in sets of from three to five strings each. The tuner first making a loop in the end of a string and placing it over the hitch pin, the other end is passed through the hole or eye in the tuning pin, the operator twisting it around by means of the key until it is drawn taut. Each set of strings is lettered A, B, C, etc., each string of each set being tuned up to the same pitch, according to the note wanted. There are from 40 to 48 sets of these strings in each piano, which contains from four to five octaves. The hammers are made of maple and English felting.

The felting, which costs about $5 per pound, is first glued to a prepared maple strip and sawed off into the proper widths, ranging from ⅛ inch to ¾ of an inch. The felting is white in color, and runs from ⅛ inch to ½ inch in thickness. After drying, the felt hammers are covered with a strip of thin leather. The hammers are connected to the keys by means of a straight piece of iron wire, which is screwed down into the top about ¾ of an inch. These keys are made of maple and are also sawed off a prepared strip into the proper width. They are about ½ inch in width and about 6 inches in length. The key frame is also made of maple, a number of slots being sawed into the strip ½ inch in width and about ½ inch apart. The lower ends of the keys are then put into the slots. A wire running through the center of the end of the frame passes through the center of each key, holding them in place. Connected to each key is a brass wire spring, one end being attached to a key and the other to the key frame.

When the stroke of the hammer is made this spring draws the hammer back instantly, causing the strings to give a full round tone. If the hammer remained against the string after the stroke, the tones would be dead. The barrel or cylinder containing the pins runs from 28 to 36 inches in length and 14½ inches in diameter and is made of whitewood about 1 inch in thickness. The barrel revolves on a movable table or platform which can be removed from the case by means of a circular door in the side of the piano. The placing of the pins on the barrel causes the hammers to strike the strings. These pins are of three sizes. The large or square pins representing whole notes, the circular medium size, the half notes and the small ones the trills. When the cylinder revolves, these pins strike or come in contact with a pin connected to the bottom of each key. As the pin on the cylinder moves forward it pushes the key pin backward, which in turn draws the hammer forward. As soon as the key pin escapes from the cylinder pin the hammer flies back and strikes the strings. The space between the pins and their height above the surface of the barrel distinguishes the whole and f notes from the half notes. These pins project from the surface of the barrel from ⅛ inch to ¼ inch. The half notes, which are the medium sized pins, project up about half the height of the whole notes. The trills are made with the small pins, they being placed one after the other as close as possible. In striking, the hammers are drawn back from ¾ of an inch to 2 inches. The tune is formed on the barrel in the following manner. The barrel is first covered with a clean piece of wrapping paper and placed in position in the case. A line is then drawn across the top where the tune is to begin. If the piece begins with the note A or B or C, etc., the key above with the projecting pin that strikes the string marked A or B or C, etc., is drawn down so that the pin punctures the paper. This operation is repeated until the tunes, which are ten in number, are punctured on the paper. The barrel is then withdrawn and is ready for the pins. These pins are about ¾ of an inch long and made of steel. They are forced into the surface of the barrel by hand, the operator putting the pins into the slotted jaws of a pair of pincers and pressing them down and into the paper and wood, where it is punctured. For ten tunes it takes about 6 pounds of these steel pins, amounting in numbers to about 16,800, the operation taking from 3 to 6 days. The barrel is shifted from one tune to another by means of a small wheel, the surface of the side nearest the barrel being raised at different elevations. The wheel is operated by turning a knob or button on the outside of the case. A small pin projecting out of the end of the shaft bears against the small wheel, which when turned causes the barrel to shift its position. The barrel when turned revolves at the rate of 1 revolution per minute, each revolution making one tune. It takes four skilled men about three weeks to make one of these pianos. They cost from $160 to $180 and are



THE STREET PIANO INDUSTRY.

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guaranteed for two years. New tunes are put on the barrels at a cost of $5 each. The cases are made of birch highly polished. The piano when finished weighs about 300 pounds. The sketches were taken from the manufactory of Giovanni Mina, New York City.

Food for Fever Patients.

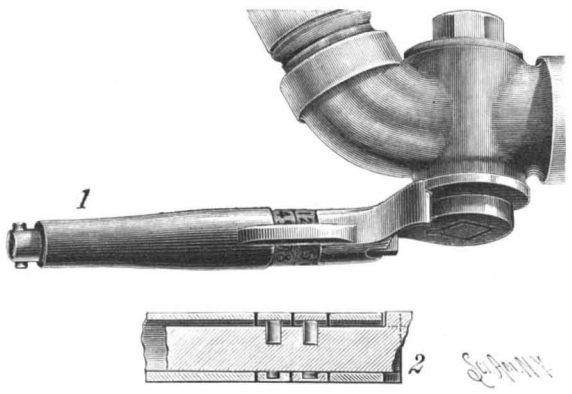
Dr. Peabody, in the Medical Record, expresses his belief that, in all kinds of illness, and especially in fevers, attention should be paid to the appetite and desire of the patient, and that, if a patient is really hungry, solid food, of a properly selected kind and in judicious quantities, will rarely disagree with him. Dr. Peabody believes there is less danger of doing harm to an ulcerated ileum in typhoid fever by giving finely divided egg, beef or chop than by giving milk, and habitually gives his typhoid patients who are hungry such food. He believes that it is a mistake to withhold solid food merely because a patient has fever, and that it is incorrect to regard milk as a fluid food, as is commonly the case, the simple fact being that milk will always remain the most serviceable general food in disease, but where it fails to nourish the patient, or where it is not well borne, or for any reason cannot be taken, it is to be considered that efficient adjuncts and substitutes are within reach.

A MUSSUCK RACE.

At the Calcutta swimming bath ladies attend in large numbers to witness the annual sports and races. Among all the exhibitions of swimming, racing, and diving, none produce merriment like the mussuck race, which has to be swum in full costume, with boots and tall hats, any competitor being counted out who arrives at the goal—one hundred feet from the starting point—with head uncovered. A mussuck is a tanned goat skin, which, when used by water carriers, has all the openings sewed up except at the neck, and is in use throughout all those parts of India where British civilization has not laid on pipes. For the race they are inflated with air, the neck of the opening closed, and the racers have to bestride them and make their way by paddling along the bath. Our illustrations (which are from sketches by Mr. Frank Scallan, of Calcutta) show how those who hurry get underneath, while the wary one who goes slowly preserves his equilibrium till the end.—From the Graphic, London.

A LOCKING STOP COCK FOR TRAIN PIPES.

To prevent the interference by unauthorized persons with the operation of air brake systems, a locking mechanism for the stop cocks of train pipes has been invented by Mr. John T. Eldridge, of Murfreesboro, N. C., and is illustrated herewith. The stop cock casing has in its lower portion a segmental recess at whose ends are shoulders or lugs, and the stem of the valve has on its upper side a lug which works in the recess,



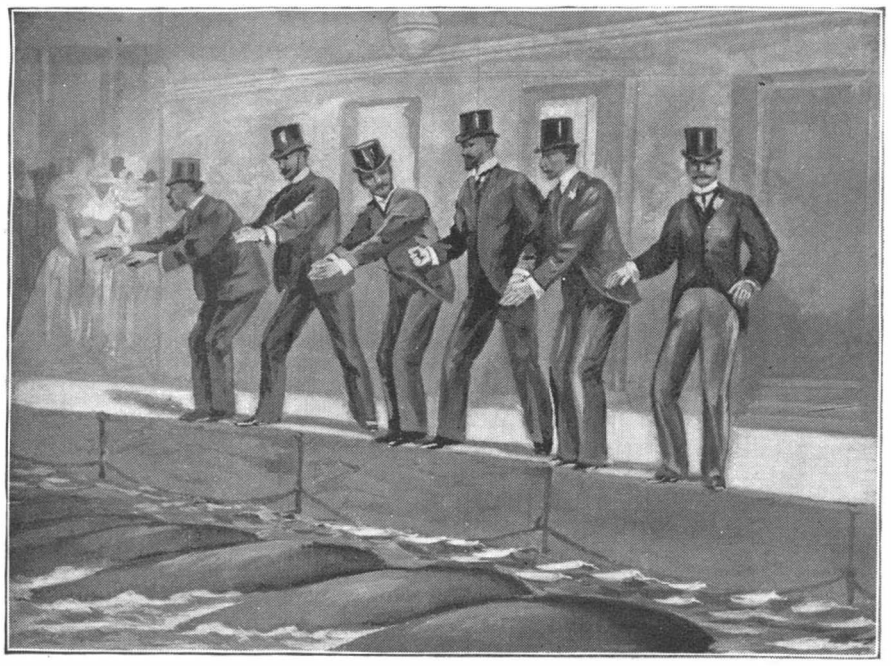
ELDRIDGE'S LOCKING STOP COCK FOR TRAIN PIPES.

engaging one shoulder when the cock is open and the other shoulder when the cock is closed. On the lower side of the handle, near its inner end, are longitudinally aligned studs, and a locking sleeve turns and has longitudinal movement on the handle, being held from removal by a stop at the outer end. The sleeve has a longitudinal internal groove, permitting it to pass the studs, and is cut away on opposite sides to form an open chamber within which are permutation rings having internal annular and intersecting transverse grooves which operate in connection with the studs, as shown in Fig 2. The inner end of the sleeve also has on opposite sides notches which alternately engage the outer edge of the lug on the valve stem when the sleeve is moved inward to be locked, there being besides an inner extension or arm of the sleeve which engages one of the shoulders of the valve casing, as shown in Fig. 1, when the cock is to be locked in open position, the arm engaging the other shoulder when the cock is locked in closed position. When the outer sides of the permutation rings are turned to bring the figures which form the "combination" into alignment, the internal transverse slots or grooves of the rings will register with the studs on the lower side of the handle, and the locking sleeve will then be free to be moved and rotated.

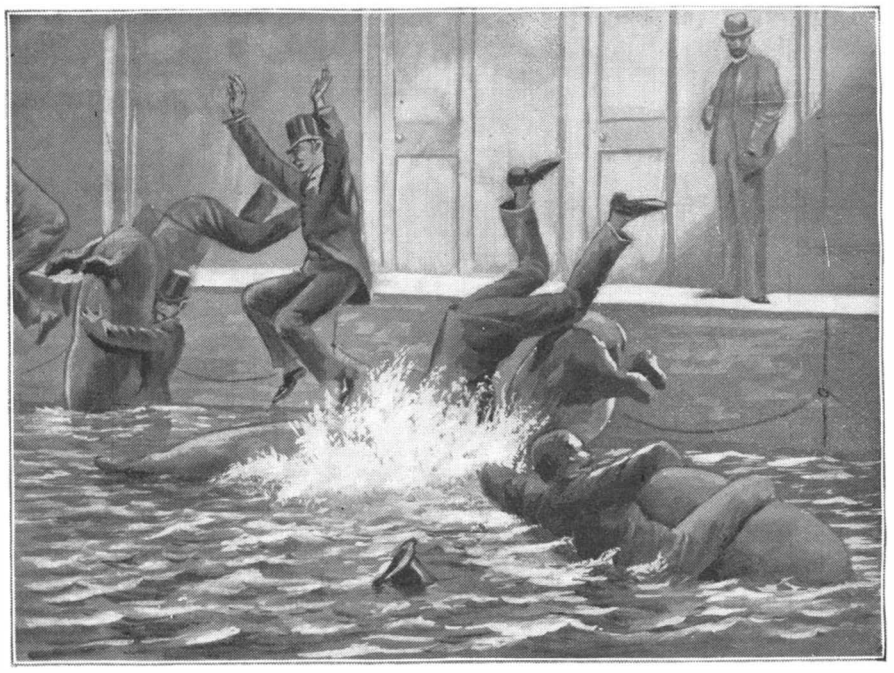
The Trouble New York Builders Have.

A prominent builder tells one of our city contemporaries that building in New York is at the present time quite a game of chance. After the contracts are all made, the cellar blasted out and the foundations laid, it would appear to be an easy matter to go ahead to completion.

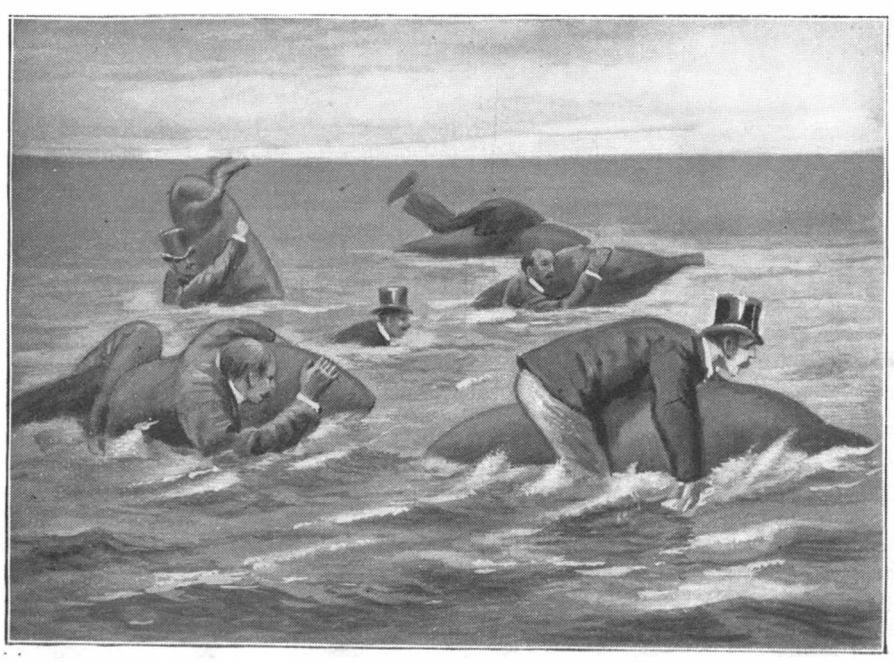
"On the contrary," said he, "your troubles are likely to just begin. There are the stone workers, the brick contractors, the terra cotta man, the plasterers, the trimmers, etc. I've got some houses not done yet which were to have been completed by the first of September. My money is invested in an expensive piece of ground, and the houses will not be ready to catch the fall renter and buyer. Even when completed now they will probably remain vacant till next May. The stonework was delayed, in the first place, by trouble between a contractor and his men. Then the brick contractor commenced delivering the wrong kind of brick. When that dispute was settled in my favor and the brickwork begun, we were a full month behind. The terra cotta came from the West and the bricklayers had scarcely got to it before we found certain pieces missing and had to send out to Ohio or Indiana for them. Then everything appeared to be going on satisfactorily and we thought of catching up the lost time. But as soon as the first coat of plaster was on, a strike among plasterers broke out. We had nothing to do with it, but all our men went out just the same. This threw out the trimmers. By the time the difficulty had been settled with the plasterers we were threatened by a similar row among the trimmers and joiners. I don't know how it is going to come out. The building trades of this city are united, and no builder is really safe until he is completely out of the woods. These sympathetic strikes have so many ramifications you never know where you are. There are hundreds and thousands of dollars tied up in uncompleted work in this city—yes, and other hundreds of thousands that would go into labor if there were any certainty about it. Wherever we lose money by this labor also loses, for it makes building cost more and makes capital timid of investment."



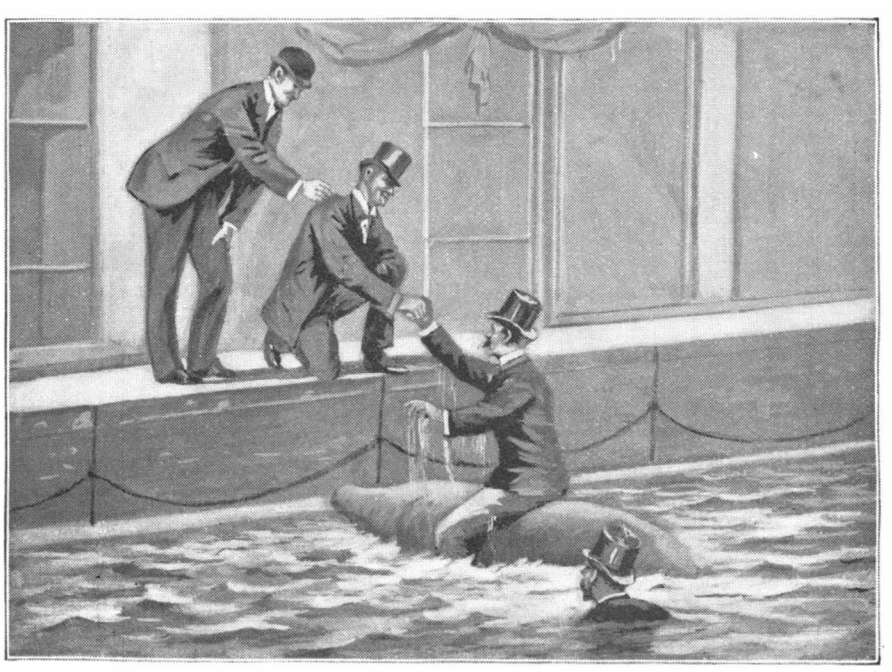
THE START.



THE PLUNGE.



THE RACE.



THE WINNER.

A MUSSUCK RACE, CALCUTTA.

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Mr. Edison's Kinetoscope in London.

The latest, and not the least remarkable, of Mr. Edison's inventions is the kinetoscope, of which a private demonstration was given recently at 70 Oxford Street. The London Times says: This instrument is to the eye what Edison's phonograph is to the ear, in that it reproduces living movements of the most complex and rapid character. To clearly understand the effect it is necessary to explain the cause, but to appreciate the result the working of the invention must be witnessed. The moving and, apparently, living figures in the kinetoscope are produced in the following manner: Mr. Edison has a stage upon which the performances he reproduces are enacted. These performances are recorded by taking a series of 43 photographs in rapid succession, the time occupied in taking them being one second only. Thus every progressive phase of every single action is secured, and the photographs are successively reproduced on a film of celluloid of the length required for recording a given scene. When this film is passed before the eye at the same rate of speed as that at which the photographs were taken, the photographically disjointed parts of a given action are united in one complete whole. Thus supposing a person to be photographed taking off his coat—as is done in one case—the successive views representing the phase of action at every forty-third part of a second are joined up, and the complete operation of taking off the coat is presented to the eye as it would appear in reality. In other words, the kinetoscope is a perfect reproduction of living action without sound.

The apparatus in which the reproduction takes place is a cabinet about 4 ft. high, 2 ft. wide, and 1 ft. 9 in. deep. It contains the celluloid film band, the apparatus for reconstructing the disjointed views, and a small electric motor for driving the apparatus. The chief detail of the mechanism is a flat metal ring having a slot in it, which makes about 2,000 revolutions per minute. The film passes rapidly over the ring, beneath which is a light. The spectator looks through a lens on to the film, and every action recorded on it passes under his view. Ten machines were shown, in which the most rapid and complex actions were faithfully reproduced. One scene represents a blacksmith's shop in full operation, with three men hammering iron on an anvil, and who stop in their work to take a drink. Each drinks in turn and passes the pot of beer to the other. The smoke from the forge is seen to rise most perfectly. In another view a Spanish dancer is shown going through her graceful evolutions, as is also Anna Belli in her serpentine dance. There is likewise a wrestling scene and a cock fight, in which feathers are seen to fly in all directions. All the features of an original stage production are given, of course on a small scale, but possibly only for the present on a small scale, for Mr. Edison promises to add the phonograph to the kinetoscope and to reproduce plays. Then by amplifying the phonograph and throwing the pictures on a screen, making them life size, he will give the world a startling reproduction of human life.

The Hygiene of Sorrow.

In a recent issue of a New York newspaper an article by Dr. Louise Fiske Bryson formulates some distinctly modern views upon the effects of grief. The attempt to act as if nothing had happened after the advent of some misfortune, and to conduct life exactly as before, is one of the greatest possible mistakes. It is an outrage on nature, which she resents sharply in the end. Pay day comes sooner or later; and the overthrow caused by blinding catastrophe arrives, even if deferred.

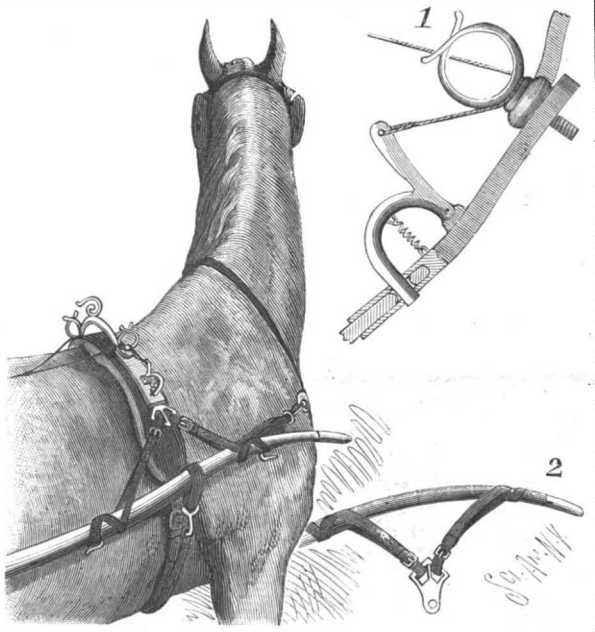
The nervous system requires complete rest after blows caused by sorrow. Recent medical observations (Fere, Bassi, Schule, Zenker) show that the physical results of depressing emotions are similar to those caused by bodily accidents, fatigue, chill, partial starvation, and loss of blood. Birds, moles, and dogs which apparently died in consequence of capture, and from conditions that correspond in human beings to acute nostalgia and "broken heart," were examined after death as to the condition of their internal organs. Nutrition of the tissues had been interfered with, and the substance proper of various vital organs had undergone the same kind of degeneration as that brought about by phosphorus or the germs of infectious disease. The poison of grief is more than a name. To urge work, study, travel, the vain search for amusement, is both useless and dangerous. For a time the whole organism is overthrown, and temporary seclusion is imperative for proper readjustment. After some bereavement the custom of wearing mourning has a distinct moral value. But its period of use must be brief: a few weeks, months, perhaps a year; otherwise dense black draperies become a burden, an æsthetic blunder, and a source of depression in themselves. For a time they have a place, securing consideration from strangers and silence from mere acquaintance, since sorrow is one of the touches of nature that makes the whole world kin.

Where there is nearness of relationship to nature, rambles in the open air, days alone with the sea, alone in the forest, console as nothing else can. Quiet, silent drives, or even short journeys by rail, will reveal a new heaven and a new earth to one fatigued and worn by sorrow. Music, when it can be borne, has a soothing power beyond words. Books, too, have their place, those gentle companions without speech whose calm society helps annihilate time and space, and who always receive us with the same kindness. The familiar faces of newspapers and journals bring a stray comfort that even the tenderest heart is powerless to bestow. The care and companionship of children is another source of strength. Children are not watching to see how the afflicted are bearing up under sorrow, nor are they waiting for some expression of sentiment or the overthrow of self-control. A child is always the best comforter, uttering no word of sympathy, yet rousing interest in life because its nature is sweetness and light.

Grief cannot be ignored, neither can it be cheered up. It must be accepted, and allowed to wear itself away. Readjustment comes slowly. Sorrow, grief, and all great misfortunes should be regarded as conditions similar to acute infectious diseases, which they resemble in result; and later, as convalescence from such diseases. Seclusion, rest, sleep, appropriate food, fresh air, sunshine, interests that tax neither mind nor body, these are requirements in this class of illness. The care of the condition following depressing emotion calls for the same treatment in greater or less degree.—Medical Record.

AN IMPROVEMENT IN HARNESS.

The illustration represents a harness with which a horse may be readily hitched to the shafts or instantly detached therefrom in case of a runaway. It forms the subject of a patent issued to Mr. Ricardo Ortega, of Ciudad Porfirio Diaz, Coahuila, Mexico. On the jockey plate, on opposite sides of the saddle,



ORTEGA'S HARNESS.

is secured a separate bar, as shown in Fig. 1, having in its lower end a recess to receive the apertured end of a plate engaged by straps fastened to the shafts as represented in Fig. 2. The latter plate is locked in place on the bar by a pivoted U-shaped bolt, the pivoted end of the bolt having an upwardly extending arm connected with one end of a cord passed around the base of the terret and thence extending to the driver's seat. There is a spring connecting the bolt and bar, to hold the bolt normally in the position shown in Fig. 1, but by pulling on the cord the outer end of the bolt is withdrawn to release the plate engaging the straps attached to the shafts, thus releasing the animal from the vehicle. The saddle has the usual belly band, and on the shafts are held loops connected with an additional band passing under the belly of the horse, to prevent the rising of the shafts.

Medical Etiquette among the Ancients.

There is an old manuscript in the National Library, at Paris, which has the following: "On approaching the patient you should assume a calm expression and avoid any gesture of greed or vanity, greet those who salute you with an humble voice, and sit down when they do. Then turning to the sick person, ask him how he is, and examine his urine. To the patient you promise to cure, but immediately on leaving the room you say to the relatives that the disease is grave. The result will be that if you cure him, your merit is greater, and you will receive the greater praise and fee, while, if he dies, they will say that you had no hope from the first." On the subject of table manners for the doctor, it proceeds to say: "When those who preside over the house ask you to the table, conduct yourself in a seemly manner. Each time that a new dish is brought on do not fail to ask for the condition of the patient. This will give him great confidence in you, as he sees that in the midst of the variety of the repast you do not forget him. On leaving the table return to the patient, and tell him that you have dined most excellently, and that everything was served to perfection. The sick person who was anxious about these points will rejoice at your words."

Why Leaves Fall.

Why leaves fall is thus explained in a recent number of the Gardeners' Magazine:

As Kerner remarks, in stating his views on the question, it appears strange that the fall of the leaf should be sometimes connected with the approach of cold, and sometimes with hot weather; but it is very conclusively shown that this is the case. Heat and cold are only indirect causes, the primary cause being the danger threatened to the plant by the continuance of transpiration; and it is contended that the throwing off of the transpiring surface and the temporary stoppage of the sap current furnish one of the best protective measures in plants surrounded by air against excessive transpiration. Again, in autumn the absorbing activity of the roots is so reduced by the low temperature of the soil that the water which is lost by transpiration is no longer replaced. Frost hastens the fall of the leaf, but it was partially accomplished before frost set in; and where the leaves still cling to the branches preparations are already made for their detachment. Kerner is careful to point out that it must not be assumed that the plants foresee the approach of either the dry season or the winter, and he explains the phenomenon on the assumption that in a climate which renders a long cessation of transpiration necessary those plants flourish best whose natural characteristic is to follow a period of energetic working by a season of rest. Plants differ materially in the time of their shedding their leaves, trees growing on mountains losing their foliage several weeks in advance of those in the plains, although much later in coming into leaf. Primarily, the stripping of the leaves depends upon the drying up of the sources from which they obtained their water, and the detachment is brought about by the formation of a special layer of cells known as the layer of separation. This consists of a parenchymatous tissue, and the walls are so constructed that they are easily separated by mechanical or chemical agents. As soon as restriction of transpiration commences, thin-walled cells are formed in the lower part of the leaf or leaflet, and form a zone. When the layer has attained its proper thickness its cells separate from each other, the so-called middle lamella of the cell wall is dissolved by organic acids, and continuity between the cells of the layer of separation destroyed, with the result that the most trifling cause will effect a fracture and bring the leaf to the ground.

Sunken Vessels Raised by Air Bags.

An improved method of raising vessels, in which air bags are employed, has been invented by Grant Brothers, of New York and Tacoma. The bags are attached to the vessel and air pumped into the bags, the invention being such that the air pressure never exceeds the water pressure; hence no bursting of the bags can take place. When a sufficient number of bags are attached to the vessel and the air pressure admitted to them, the vessel rises to the surface and there remains so long as the air pressure is maintained.

The new method was lately applied in raising a schooner which had been sunk in this harbor by a collision with steamer. Messrs. Grant write as follows:

"We raised the schooner Almira, register 90 tons, 23 feet beam, 95 feet long, 5 feet 8 inches hold, on Saturday, October 13, 1894, at Quarantine Station, Staten Island, which was sunk in about 10 feet of water, or 4 feet over all. She was stove in so the tide rose and fell in her, rendering it impossible for any pumps now in use to keep it clear or raise her. It required only six bags, 4½ feet in diameter and 24 feet long, to give sufficient displacement to raise her, leaving her decks dry. Her deck was partially torn off and several deck beams were broken away at the ends. In one hour and five minutes after lying alongside we had the bags placed and ready to raise, and inside of four hours from that time we had her at the drydock at Port Richmond. The drydock being in use at the time, we let the schooner sink near by, and on Thursday, October 18, we raised her the second time and placed her on the dock for repairs, and upon examination, after she was on the dock, disclosed the fact that she was in such a condition that it would have been impossible to pump her out or expel the water by any other process except Grant Brothers' air bag system."

Dr. Roux's Cure for Diphtheria.

A few weeks ago the Paris Figaro opened a subscription list in order to enable the Pasteur Institute to supply Dr. Roux's antidiphtheria serum to all medical applicants. The appeal has resulted in a sum equivalent to about $50,000 being raised. It is hoped that institutes in which experienced physicians will administer the cure will soon be established. The Paris Academy of Medicine has reported in favor of Dr. Roux's treatment.

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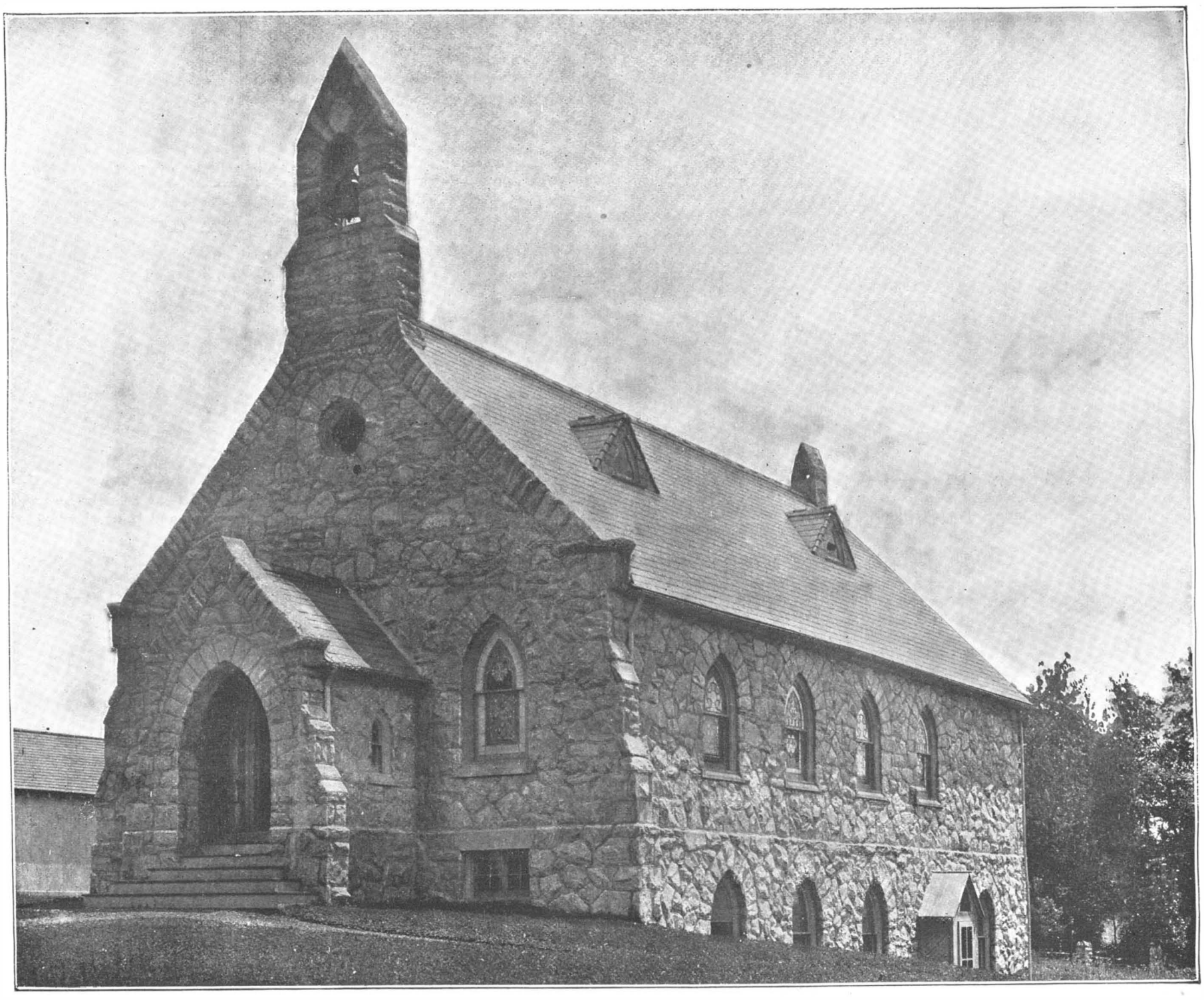
A STONE BAPTIST CHURCH.

Our engraving represents the First Baptist Church, recently completed at Warberth Park, Pa. The design is unique. It is of the Gothic style of architecture. It is built of rock-faced Chestnut Hill granite of a grayish blue color, laid up at random in red mortar. Roof slated and finished with a tiled cresting. Dimensions: Front, 29 feet; side, 69 feet. The interior thoughout is finished with oak. The auditorium, 26 feet × 57 feet, has a seating capacity of 280. It is lighted by stained glass windows, shedding a pleasant light over the auditorium, altar and choir box. The pastor's study is placed conveniently. The basement contains Sunday school room, two class rooms, and furnace room, besides other apartments. These apartments are furnished complete. Class rooms are connected to Sunday school room by double sliding doors, and are so arranged that they can be thrown together at pleasure. Cost of church, exclusive of furniture, $6,000. The stone was accessible, rendering the cost less than the church could be built for in many other places.

Our engraving was made direct from a photograph of the building, taken specially for the ARCHITECTS AND BUILDERS edition of the SCIENTIFIC AMERICAN.



A SIX THOUSAND DOLLAR STONE CHURCH.

Earthquake Effects on Brick Buildings.

A letter of Messrs. Ende & Boeckmann, of Berlin, to our contemporary, the Deutsche Bauzeitung, gives us some interesting particulars of the effects of the late earthquakes on the new public buildings these architects have erected at Tokio. We refer to the earthquake that passed over Japan on June 20 last. It seems that the shock lasted no less than four minutes and fifty seconds, and that the buildings rolled perceptibly. While all the other brick buildings suffered badly, Messrs. Ende & Boeckmann's blocks apparently withstood the shocks without showing a crack. This escape seems to have been mainly due to the precaution of tying in all the brickwork with iron bands, both horizontally and vertically, no part of the building being omitted; and, further, in building the exterior slightly inclined inward. The walls are built unusually thick. The designs purposely showed no gables, and in vaulting very narrow spans were arranged for. On referring to official information regarding the earthquake, we hear that at Tokio and Yokohama together no less than 4,551 buildings were damaged, and that sixty-one persons were killed and 428 hurt by falling houses. Thirty-two buildings collapsed completely, and eighty-one were practically razed; five bridges gave way. Of course, the majority of these buildings were of native construction; but these, as usual, apparently withstood the shock far better than the average "European" structure.—The Builder.

A Great Tunnel Completed.

A notable piece of mining work was brought to completion, says the Mining and Scientific Press, at Park City, Utah, lately after over six years of constant labor. This is the Ontario drain tunnel, which will drain the Ontario, Daly and Daly West mines, with which it has direct connection. It is expected that it will also reduce the water in the Silver King and other properties. The rate of flow through the tunnel before its connection was made was about 13,000 gallons per minute. As soon as the cleaning up is all done the great Cornish pump will be stopped, and all the water will flow through the tunnel. The mines are capped at a depth of 1,500 feet.

This tunnel is 15,490 feet long and it took six years and three months to run it. The average cutting per day was six and three-fourths feet. The completion of this tunnel will effect an enormous reduction in the operating expenses of the mines. The great Cornish pumping plant, which represents an outlay of nearly $500,000, will now be stopped, and no fuel will be required except for hoisting. It is estimated that the cost of ore production will be reduced about $5 per ton. On the basis of last year's production—56,000 tons from the Ontario and Daly—this would effect a saving of $280,000 and the tunnel would more than pay for itself in two years. Add to this saving the amount that has been expended yearly in the tunnel, and it will be seen that the mines will be in a position to resume dividends. The mines will continue to be worked, notwithstanding the low price of silver.

Another Large Telescope.

The great 16 inch equatorial telescope under the guidance of Dr. Lewis Swift, at the Lowe Observatory on Echo Mountain, Cal., was inaugurated September 16. The Mount Lowe Echo says: The night was black dark, the atmosphere clear and pure, and the stars stood out as brilliantly as diamonds. Dr. Swift says, never before in his experience has he enjoyed such perfect brilliancy, and in these conditions, observations become a rich delight.

In sweeping over a field doubtless often before explored when in Rochester, to his intense delight he speedily discovered four new nebulæ, thus, at once, demonstrating the superior capacities of his wonderful glass in this pellucid atmosphere, and giving a foretaste of what may be confidently anticipated when all the final adjustments of the telescope are made and it is in regular operation. Dr. Swift is ably seconded by his gifted son Edward, who will soon inaugurate a system of making stellar photographs with the 16 inch equatorial.

The Longest Passenger Train.

A correspondent sends us a clipping from the Sioux City Journal, which states that about five miles west of there is a park called Riverside Park. It is situated on the Sioux River. At this park was held an interstate fair. On October 11 the Milwaukee Railroad pulled in from Riverside Park a train consisting of 28 passenger coaches. It is estimated that there were something like three thousand passengers on this train.

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The Relative Strength and Length of Limbs in Man and Woman.

From the last report of the Anthropometric Laboratory, of London, we extract the following interesting data as to the relative strength and length of limbs in man and woman.

In man, in 50·9 cases out of a hundred, the right arm is stronger than the left. In 16·4 cases, the two arms are of equal strength. Finally, in 32·7 cases out of a hundred, the left arm is the stronger. Thus (and here is a fact that appears to be little known), out of every ten men, there are more than three whose right arm is not as strong as the left. The proportion is better distributed in women. Out of a hundred, only 46·9 possess more strength in the right arm, and 24·5 (say nearly one-fourth) have more strength in the left. Dynamometric experiments have likewise proved that in women the upper limbs possess the same strength much oftener than in men, since out of a hundred there are 28·6 that have given the same results in the two arms. As regards the respective length of the limbs, we see that in most cases the right arm and the left leg are the longer. Upon measuring fifty skeletons of adults, of men as well as women, the Laboratory found the following proportions. In twenty-three cases, the left leg and the right arm were the longer, in six cases it was, on the contrary, the right leg and the left arm, and in four cases only the limbs of the right side were longer than those of the left. Finally, in seventeen cases, all the limbs were more or less unequal in length.

Curious Facts About the Eskimos.

Mrs. Peary, the only lady to take part in any Arctic expedition, spent a year in Greenland. She has recently published her journal,* the contents of which are summarized in the Spectator, London. We quote:

"The wooden house which the exploration party built on the north coast of Inglefield Gulf, some miles due north of Whale Sound, was the base of operation for Mr. Peary's expedition to the north coast of Greenland, across the inland ice. The explorers sighted Greenland on June 24, 1892, and at the end of July landed and built the house. Mr. Peary, his leg having been broken by a blow from the ship's tiller, was unable to take any active part in work, and it was not till the spring was at hand that the broken limb recovered its real strength, just in time, indeed, for the ice journey. When the house was finished, several men of the expedition were sent to search Herbert and Northumberland Islands for an Eskimo settlement, and to induce a family to settle down near the house and make themselves useful—the man to act as hunting guide and the woman to do the sewing of the many skin garments. They returned with one family, and the first proof of his skill the Eskimo gave was to cut up a huge walrus with a six-inch pocket knife.

"Of course the prevailing characteristic of the Eskimos in Mrs. Peary's estimation was their dirtiness, and it was as a very great favor that she finally allowed the best sewer to squat on the floor in her own room. Indeed, the habits of the Eskimos never failed to excite her disgust, and she tells with horror how, when the Eskimo man had been given leave to bring home a cached seal, the most awful smell pervaded the place from the two-year-old corpse. Ikwa, the Eskimo, was most indignant at the refusal to allow it to be carried in the boat, declaring it to be 'the finest kind of eating for himself and family.' On November 23, Mrs. Peary notes that it was impossible to read ordinary print at noon, and henceforth the only difference between day and night at Redcliffe House was the addition of a 'large Rochester lamp' to the bracket lamps from 8 A. M. to 10 P. M., called by the Eskimos the 'Baby Sun.' A rule was made by the commander of the expedition that no member should occupy his bunk between 8 A. M. and 7 P. M., unless ill. The best sewer was a woman named M'gipsu, and she was Mrs. Peary's favorite, having also the additional distinction of forming with her husband and children the most northerly family on the globe. Mrs. Peary tells us the manner of preparing the clothes for the great ice journey. Her husband gave her an idea of the kind of garment he wanted, and she cut out experimental outfits of canton flannels; these, if satisfactory, served as patterns for the skins, so that no waste of skin occurred. How the natives prepared the skin, let Mrs. Peary relate:

"'The native method of treating the skins of all animals intended for clothing is first to rid them of as much of the fat as can be got off by scraping with a knife; then they are stretched as tight as possible, and allowed to become perfectly dry. After this they are taken by the women and chewed and sucked all over in order to get as much of the grease out as possible; then they are again dried and scraped with a dull implement so as to break the fibers, making the skins pliable. Chewing the skins is very hard on the women, and all of it is done by them; they cannot chew more than two deerskins per day, and are obliged to rest their jaws every other day.'

"More Eskimos arrived, till the permanent camp of the expedition became an Eskimo village. Two of the men were reported to 'swap' wives every year; they were the only two men in the tribe who did so; and though the other men regarded it as reasonable, the women were not satisfied with it. One of the newcomers, who had recently lost her husband, drowned by a seal, was asked by Mrs. Peary if the three children she had with her were all; she burst into tears, and left the room. On questioning her favorite, M'gipsu explained, after much hesitation, that Klayuh, the widow, had just strangled her youngest child, about two years old. She could not support the child herself, and no man would take her to wife with a child in the hood, where the women carry their children till they can get about themselves. M'gipsu, when asked if this was always done, said, 'Oh, yes; the women are compelled to do it.' When M'gipsu sat in Mrs. Peary's room, her husband, Annowkah, came in as often as he could find an excuse for doing so. 'He frequently rubs his face against hers, and they sniffle at each other; this takes the place of kissing. I should think they could smell each other without doing this, but they are probably so accustomed to the (to me) terrible odor that they fail to notice it.'"

* "My Arctic Journal: A Year Among Ice Fields and Eskimo."

Railway Across the Devil's Dike.

A new telpher railway across the Devil's Dike, on the Sussex Downs, was recently opened by the Mayor of Brighton. The track cables of the railway are carried upon a series of supports attached to a powerful catenary cable which is secured to the sides of the gorge, the structure being steadied and further strengthened by iron columns at about 200 feet from the extremities of the railway. The main cable is 1,200 feet in length, the space between the two stations about 1,100 feet, while the span between the columns is 650 feet. The wheels on which the cars run cannot get off the tracks, one set of wheels always controlling the opposite set. The cars are conveyed at a height of about 230 feet above the lowest point of the gorge, and are moved by an endless cable worked by a Crossley's oil engine. There are two cars at present in use. The mayor and mayoress were the first to cross and spoke of having had an agreeable experience.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR VENTILATOR.—Benjamin F. Hughson, Cold Spring, N. Y. This device has a tubular body, open at both ends, which flare outwardly, and is fastened to the side of the car roof to afford passageways leading into the interior, there being pivoted at the junction of the two passageways a flap valve, operated by the motion of the car to create a current which draws out the foul air. The device is very simple and cheap, and may be readily applied to an old car as well as when the car is being built. It operates automatically and may also be conveniently operated by hand.

MAIL BAG HANDLER.—Edward Davies, Whittington Hall Farm, near Stourbridge, England. To deliver mail bags, etc., to or from trains in motion, this inventor has devised an apparatus consisting of two members, one attached to the car and the other to the roadside platform, the members acting as radius links, and the package while being transferred gradually acquiring or ceasing to partake in the motion of the train. The arrangement is such that the radius members act conjointly on the package throughout its flight, both as regards the initiation, the change of direction, and the arrest of its actual or relative motion.

Mechanical.

GRINDING MILL.—Charles C. Howe, Westerly, R. I. This is a mill more especially designed for grinding mica and similar substances in a liquid. It has a receptacle with a bed in its bottom and a circular band at the side, the muller carried around resting on the bed, while there is an elastic band in the periphery of the muller in frictional contact with the band in the side of the receptacle. In grinding mica the muller is of stone and runs on a hard wood bed, the blocks having their grain on the end, and thus giving great brilliancy to the mica, which is rather smoothed or flaked than ground.

WATER ELEVATOR.—Joseph McMurrin, Shoshone, Idaho. This elevator is adapted to be placed in a running stream and operated by the current. A substantially triangular frame is temporarily anchored or permanently placed in the stream, its upper portion carrying a sprocket wheel, and there being at its lower corners drums having sprocket sections, actuating an endless sprocket chain carrying a series of buckets. The end drums on the lower horizontal section of the frame are driven by paddles propelled by the current, these paddles being on endless belts passing over the end portions of the drums.

CHILL FOR MAKING CHILLED CASTINGS.—Herbert Schon, Apollo, Pa. The chilling surface of this chill is formed by a series of hollow chill blocks, constituting cooling chambers, each connected at its lower end by a port with an annular waterway connected with a water supply source and also with a steam supply. Each chamber is also connected at its upper end with another waterway and an outlet for water and steam. The chill may thus be first heated up with hot water and steam, and cold water only be circulated through it after the metal has been poured, the temperature of the water, and the consequent hardness of the casting, being largely under control.

Agricultural.

RIDING ATTACHMENT FOR PLOWS.—James Kleihauer, Jr., Johnson, Neb. This is a device of simple and inexpensive construction, readily applied and adjusted to any kind of walking plow. It virtually comprises two frames, a forward and right hand frame embracing a cross bar and attached parts, and a left hand rear frame, both frames being of angular construction. When the plow is to be used again as a walking plow the attachment may be readily removed.

Miscellaneous.

DRAG FOR SUCTION PIPES.—Ernest O. Patterson, Charleston, S. C. The body of this device has a wide, downwardly curved mouth, on the front side of which is a shaft carrying a valve for closing an inlet near the mouth opening, there being on one end of the shaft a weighted lever connected by a rope with the dredging boat on which is the pumping machinery. The valve is normally closed, but when a large amount of sand or other material fills the mouth so as to cut off the necessary supply of water to insure proper suction, the valve is opened by means of the rope, permitting water to be drawn in to cut up the choking material. The improvement precludes the necessity of pulling up the suction pipe in case of its choking.

BAILING DEVICE.—John Fatkin, Aspen, Col. A bucket having a valved outlet for its lower portion, and also an inlet valve, with a tripping device for unseating the valve in the outlet, form the main features of this invention, which has been devised for readily emptying flooded mines of their surplus water. It temporarily takes the place of the usual cage, and automatically fills itself when lowered into the water in the mine shaft, automatically discharging into an outlet chute when raised to the mouth of the shaft or other discharging point.

REFRIGERATING APPARATUS.—Ernest W. Carleton and James M. Odell, Austin, Texas. This invention provides means for lowering the temperature in a partially closed chamber by evaporating water by means of capillary attraction, automatically maintaining, also, a specified water level in the water chamber and good ventilation of the cooling chamber. The warmer the weather, the greater will be the difference between the temperature inside of the cooling chamber and that of the outside air. The apparatus is especially adapted for preserving meat, butter, eggs, milk, etc., in warm weather, without the use of ice or chemicals.

BALE BOX CLAMP.—Thomas M. Wallace, Marion, Ala. With a bale box of the ordinary construction, whose ends and sides open by the expansion of the bale when the clamping devices are released, preferably two clamps of this design are used, one near each end of the box, suspended above the box by chains. The clamps have at one end a catch to engage one side of the bale box, and at the other end the clamps have eyes in which is held a shaft resting in closed position against plates whereby the side and end doors are held closed. The shaft has a handle by which it may be rolled up and off the plates when the doors open, leaving the bale free.

FLOOR CLAMP.—Moses Schlatter, Inman, Kan. The body of this device consists of two rigidly connected members in which are arranged opposing toothed studs, one of the studs being held to turn in its member, and the other turning and sliding in the opposite member, there being a lever and cam for actuating the sliding stud. With this clamp board for flooring, siding or ceiling may be brought and held in close contact while being secured in place. The construction of the device is very simple and inexpensive.

UMBRELLA.—Zebulon Wirt, Monticello, Ind. The frame of this umbrella may be readily applied to a walking stick or easily removed therefrom and placed in a pocket or small bag. It has a tubular shell, with cap flange and latches, a runner sliding on the shell and sectional ribs hinged to its cap, while sectional braces are pivoted to the runner and to the ribs. A second runner engages the latches of the shell and braces connect this runner and the ribs. The cover is attached to the frame in any manner known to the trade.

RIBBON DISPLAY CABINET.—Lewis Schoolhouse, New York City. This cabinet has a drawer with a transparent front, a wire forming a guide and handle for the drawer, and the casing and drawer being made slanting rearwardly, so that the rolls of ribbon are readily retained and can be easily placed in the drawer, where their size and color may be seen to great advantage. The drawer is dust proof.

PORTABLE BURGLAR ALARM.—Lars G. Larson, Moscow, Idaho. This is a small device, readily connected with the knob of a door lock or latch, to sound an alarm should the knob be partly turned. Its operative mechanism is held in a small case, with hanger loop to hang on the neck of the door knob, when a slight turning of the knob will operate a tripping cord releasing a spring-driven escapement wheel, causing a clapper to vibrate and sound a bell.

CHILD'S CRADLE.—Willis E. Phillips, Saguache, Col. The rocking supports of this cradle are pivotally connected with its ends, one at each side of the center, and pivotally connected with one another. There are link connections between the legs of the supports at opposite ends. The cradle may be readily swung with a long, regular motion, instead of the usual short, quick motion, and it is impossible to throw or move in the least the child held therein. The construction is particularly adapted to self-moving mechanisms, such as clockwork, electric motors, etc.

SASH FASTENER.—William R. Abrams, Los Angeles, Cal. This is an improvement in sash fasteners in which a toothed pawl is pivoted in a box on the window frame to engage a rack on the sash. The fastener has two toothed pawls, with teeth projecting in opposite directions, and with transverse bores in which are internal lugs out of alignment, a key engaging either lug independently. With this device the window may be left open at the top and bottom, and the further movement of the upper and lower sashes in either direction will be prevented.

CURTAIN.—Albert M. Branshaw, Escanaba, Mich. This curtain is designed to render air tight the opening over which it is drawn, and to afford a substitute for folding doors, awnings, arch closures, etc. Slideways are located at opposite sides of the opening to be closed, and have apertures through which extends a guide slot, while the curtain roller has guides which project into the slideways, and a slat bar at the lower end of the curtain has spring-controlled latches entering the apertures in the slideways. When made of fireproof cloth, for use as an awning, it is designed to afford the best possible protection, and it may be raised or lowered so that it will not be necessary to have any curtain on inside of building.

FRUIT HOLDER.—Thomas Leach, Taunton, Mass. This device has in its inner walls rigid vertical ribs and a series of downwardly projecting ratchet teeth, designed to hold oranges and other fruit placed therein, thereby enabling one to serve the fruit in a dainty way without it being necessary to hold the fruit in the hand.

PORTABLE COAL BOX.—Thomas Bukenhofer and Ernest H. Weiss, Terre Haute, Ind. This is a receptacle having a hinged cover adapted for extension as a scooping or discharge chute, there being a transverse bail on the upper part of the box and a looped handle at its front. A full box may be carried with more ease than the ordinary coal hod with the same amount of coal, and when the top of the box is closed there is no danger of spilling the coal.

Designs.

LAMP HEATER.—Frances Rader, Prescott, Wis. This heater design consists of a truncated cone, with overhanging annular flange, provided with openings at the top.

HANDLE FOR FORKS, ETC.—Charles Osborne, New York City. This design has rosettes and leaves at the base and top of the handle and bud-like figures at its sides.

CARPET.—Pierre C. Chambellan, West Hoboken, N. J. The carpet body, according to this design, is decorated with bouquets of the rose, dahlia and lilac type, and it has a shaded subborder.

The same designer also produces a design in which the carpet body is decorated with connected leaf scrolls, alternate scrolls being reversely curved and varied, the border being nearly the same, but with a fan-like dado.

FABRIC RENOVATOR.—Mary S. Kjellstrom, New York City. A conical tube-like figure has a narrow opening at one side, from which extend side plates in the shape of triangles, with projecting sides united.

LAST.—Nicholas Bier, Salem, Oregon. This design represents the ball portion of two lasts joined at the heel, each reversed as to the other.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

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NEW BOOKS AND PUBLICATIONS.

A LABORATORY MANUAL OF PHYSICS AND APPLIED ELECTRICITY. Arranged and edited by Edward L. Nichols. In two volumes. Vol II. Senior Courses and Outlines of Advanced Work. By George S. Moler, Frederick Bedell, Homer J. Hotchkiss, Charles P. Matthews and the Editor. New York: Macmillan & Co. 1894. Pp. 444. Price $3.25.

We have before now reviewed the author's course of physics for the lower classes. In the present book one finds more advanced researches, with the use of satisfactory apparatus given in full detail, with especial reference to electrical work. As arranged, it makes excellent reading, being far more than a mere laboratory guide, and in it the author no longer appears to avoid proper apparatus, something which, to our minds, has been a defect in some manuals used for the lower classes in practical physics; so it may be recommended to readers not only as an exponent of college teaching and methods, but also as an actual manual of physics. Its make-up is of the most advanced description, as indicated by the capitalization of as few words as possible, although italics are used in considerable number.

THE RELIGION OF SCIENCE LIBRARY. Fundamental Problems. The Method of Philosophy as a Systematic Arrangement of Knowledge. By Dr. Paul Carus. Second edition, enlarged and revised. Chicago: The Open Court Publishing Company. 1894. Pp. xii, 373. Price, cloth, $1.50; paper, 50 cents.

SCIENTIFIC AMERICAN BUILDING EDITION.

NOVEMBER, 1894.—(No. 109.)

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2. Plate in colors showing the residence of John Cottier, Esq., at Bensonhurst, L. I. Three perspective elevations and floor plans. Cost $6,750 complete. A good example of Colonial architecture. Messrs. Parfitt Bros., architects, Brooklyn, N. Y.
3. A dwelling at Edison Park, Ill. Cost $1,700. Architect, Mr. F. W. Langworthy, Chicago, Ill. A model design for its class and cost. Two perspective elevations and floor plans.
4. A very attractive residence recently erected for A. C. Garsia, Esq., at Flatbush, L. I. Two perspective elevations and floor plans. Mr. John E. Baker, architect, Newark, N. J. A modern design.
5. An $800 summer cottage built for A. R. Doten, Esq., at Casco Bay, near Portland, Me. Perspective elevation and floor plans. Mr. Antoine Dorticos, architect, Portland, Me.
6. Perspective elevations and floor plans of a handsome residence recently completed for George W. Catt, Esq., at Bensonhurst, L. I. A very picturesque design. Cost $8,100 complete. Mr. S. S. Covert, architect, New York.
7. A church at Short Hills, N. J., built entirely of rubble stone. Estimated cost $6,000. Perspective elevation and floor plan. Messrs. Lamb & Rich, architects, New York City.
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9. A stable and conservatory attached to the residence of John Cottier, Esq., at Bensonhurst, L. I. Perspective elevation and ground plan. Messrs. Parfitt Bros., architects, Brooklyn, N. Y.
10. A residence at Ardmore, Pa., in the Queen Anne style. Perspective elevation and floor plans. Cost complete $6,750. Architects and builders, Messrs. J. B. Cornell & Sons, Philadelphia, Pa.
11. A cottage at Edgewater, Ill., erected for Edgar Smith, Esq. A unique design in the Colonial style. Cost $7,800 complete. Two perspective elevations and floor plans. Mr. G. W. Maher, architect, Chicago, Ill.
12. An attractive cottage at Bath Beach, Long Island, N. Y., recently erected for G. W. Snook, Esq. Two perspective elevations and floor plans. Mr. Percey Emmett, architect, Bath Beach, Long Island.
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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
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Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(6285) W. A. S. E. asks how or in what way the canvas is prepared which is sold at art stores and whether the pores are filled with some composition or sized. A. 1 part white lead, 2 parts whiting; a small portion of litharge and sulphate of zinc for driers; mix with equal parts of boiled linseed oil and raw linseed, tinted with either brown umber or lampblack, for a neutral ground. The canvas is tacked upon a stretching frame, and sized with weak glue size, to which a small portion of zinc sulphate is added. When dry it is stippled over with some driers and linseed oil, as thin as possible, not saturated. When very nearly dry the white lead, whiting, etc., is mixed up very smooth, and put upon it very thin and smooth with a large palette knife, and hatched over with a large sash tool, drawing it across one way and then at right angles, until the face presents a face like a piece of fine linen or cartridge paper, when it is left to dry.

(6286) W. H. S. and A. K. W. ask for a cement for lining acid tanks. A. An oaken trough will last from twelve to fifteen years if coated with Burgundy pitch 1,500 grammes, old gutta percha in shreds 250 grammes, pounded pumice 750 grammes. Melt the gutta percha, mix with the pumice, and add the pitch. A hot iron passed over the surface smooths it, and assists adhesion. The box resists sulphate of copper baths, but not cyanides.

(6287) H. F. asks: Does not the attraction of the field (in a motor) of the armature, at all points directly opposite the poles, tend to stop the revolution of the armature? In other words, are not the lateral attraction of the outer edge of the field, of the pole of the armature, and the equal repulsive force of the opposite outer edge of the field, the only propelling forces that cause the armature to revolve? A. Your query is not very clear. The simplest general statement is that the armature is kept so polarized that the line connecting the poles of the field is constantly at an angle with the line connecting the poles of the armature, and the latter are constantly shifting in the direction opposed to the rotation.

(6288) L. P. says: Given a 30 inch turbine water wheel to work under 7 or 7½ feet fall, what should be the width and depth of race to convey water to the wheel? What would be the minimum space that could be allowed between bottom of wheel and bottom of wheel pit to give good results? About what horse power could be expected from a wheel of a good make of size named, working under 7 feet of fall, having all the water it could use? A. A 30 inch turbine using 750 cubic feet of water per minute under 7 feet head will equal 9 horse power and will need a race 3 feet deep 4 feet wide to maintain an approximate full head at the flume. There should be at least 2½ feet clearance under the bottom of the wheel. Wheels are made of various sizes up to 114 inches, with proportional increase in quantity of water used and size of raceway. The 114 inch wheel under 7 feet head will use 10,000 cubic feet of water per minute and produce 120 horse power.

(6289) W. L. B. says: In a double cylinder gasoline engine with cylinder 4¼×6 inches, making 250 revolutions per minute, giving 6 horse power, what is the pressure per inch at time of explosion and at what point of stroke should exhaust be located to give best results? A. There is considerable difference shown in pressure and expansion lines in gasoline engines, owing to the various mixtures of gasoline vapor and air, its most powerful effect being for a mixture 1 part vapor to 10 parts air. Under the various conditions in ordinary use, the explosive pressure may vary from 50 to 100 pounds per square inch. The exhaust should take place at the end of the stroke. See a valuable work on "Gas, Gasoline and Petroleum Engines."

(6290) J. B. D. asks: Does it make any difference in the working of a bicycle if the large sprocket wheel is set higher than the small sprocket wheel? A. There is a little difference. The chain grips best when nearly horizontal. A slight departure from horizontal will do no harm.

(6291) F. M. M. writes: 1. I wish to know how large an air pump running at say 200 feet piston speed should hold a pressure of 30 pounds per square inch, with ¼ inch nozzle outlet, open wide. Roper says steam has a velocity of 1,601 feet per second at 30 pounds pressure. Now, figured on this basis, how much air will be delivered from ¼ inch orifice, or does the velocity of air differ from that of steam? Knowing the velocity at point of discharge, at what pressure is the cubical contents of discharge represented, I mean, at free air pressure, tank pressure or an intermediate? By answering the above you will confer a great favor. Can you furnish me a book with data by which air capacities can be figured? A. The velocity of air from a nozzle of good form at 30 pounds pressure is 640 feet per second. Hence the flow from a quarter inch nozzle will be

$$\frac{640\times\cdot049\times3 \text{ vol} \times60 \text{ sec.}}{144}=39+$$

or say 40 cubic feet of free air per minute, and

$$\frac{40^{C'}}{200 \text{ ft. pr. m.}}=\cdot2^{C'} \text{ area,}$$

or 29·8 square inches, but owing to the loss in the pump by clearance, leakage and imperfect piston packing, not less than a cylinder 8 inches in diameter will do the work at the feet per minute speed as stated. The stated flow of steam as above is the theoretical velocity of steam flowing into a vacuum, but practically it is but 900 feet from 100 pounds pressure into the atmosphere. The flow of air, which is much heavier than steam, is but 952 feet per second into a vacuum, and varying in nozzle velocity from 632 to 658 feet per second, between 15 pounds and 75 pounds pressure and flowing into free air. Computations are made on the basis of free air volume plus pressure We have no complete works on air compression, but much can be gained from back numbers of SCIENTIFIC AMERICAN SUPPLEMENT, on air compression and its uses. A few useful formulas and tables are published in Haswell's "Engineer's Pocket Book," $4 by mail.

(6292) D. P. B. says: Please answer through the columns of your valuable paper, when and where the first electric car in the world was operated, also when and where the first cable car? A. The electric railway system was invented and model railways exhibited with cars driven by electricity in 1839, in New York. A practical trial was made on the Edinburgh and Glasgow Railway in 1842. See SCIENTIFIC AMERICAN, November 3, 1894, for an interesting account of the first trials. The first cable car was operated in San Francisco by A. S. Hallidie, in 1871.

(6293) E. S.—The bird's skin sent is that of a female golden crowned kinglet (Regulus satrapa), a common winter bird from the Northern States southward.—F. M. C.

(6294) W. A. V. asks how to make stencil paint. A. Take shellac, 2 oz.; borax, 2 oz.; water, 25 oz.; gum arabic, 2 oz.; lampblack, a sufficiency. Boil the borax and shellac in water till they are dissolved, and withdraw from the fire. When the solution has become cold, complete 25 oz. with water, and add lampblack enough to bring the preparation to a suitable consistence. When it is to be used with a stencil, it must be made thicker than when it is to be applied with a marking brush. The above gives a black ink; for red, substitute Venetian red for lampblack; for blue, ultramarine; and for green, a mixture of ultramarine and chrome yellow.

(6295.) M. J. W. asks for a formula for economical fuel. A. Mix coal, charcoal or sawdust, 1 part; sand of any kind, 2 parts; marl or clay, 1 part; in quantity as thought proper. Make the mass up wet into balls of a convenient size, and when the fire is sufficiently strong place these balls, according to their size, a little above the bar, and they will produce a heat considerably more intense than common fuel, and insure a saving of one-half the quantity of coals. A fire thus made up will require no stirring nor fresh fuel for ten hours.

(6296) G. de B. asks for a formula for French mustard. A. The following is M. Lenormand's receipt: Flour of mustard, 2 lb.; fresh parsley, chervil, celery and tarragon, of each, ½ oz.; garlic, 1 clove (or head); 12 salt anchovies (all well chopped); grind well together, add salt, 1 oz.; grape juice or sugar to sweeten, and sufficient water to form the mass into a thin paste by trituration in a mortar. When put into pots a red hot iron is momentarily thrust into the contents of each, and a little wine vinegar added.

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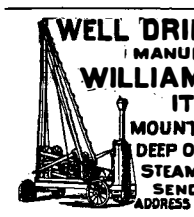

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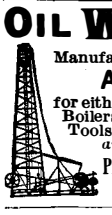

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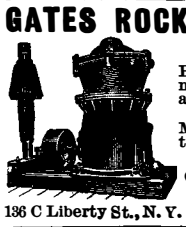

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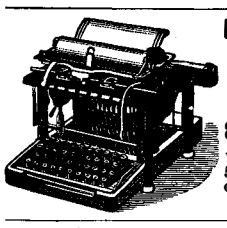

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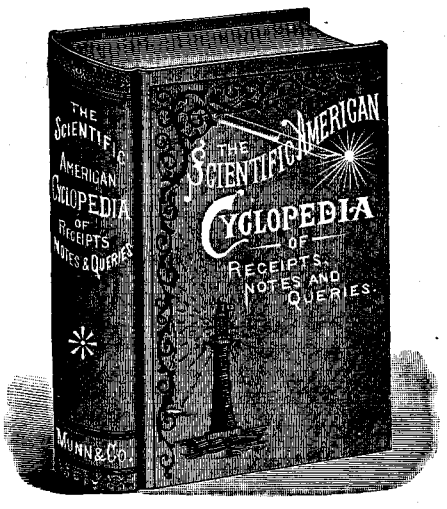

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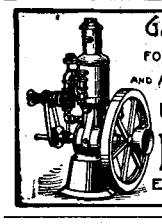

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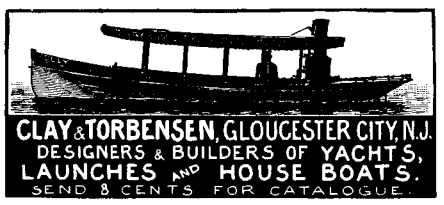

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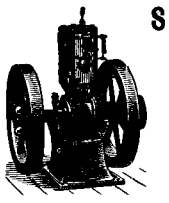

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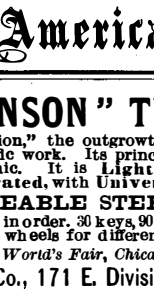

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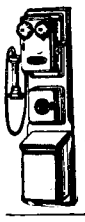

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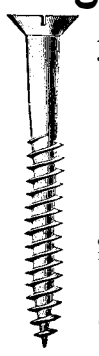

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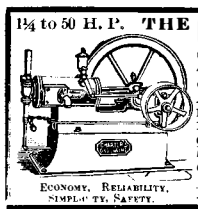

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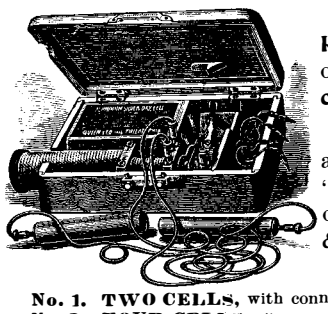

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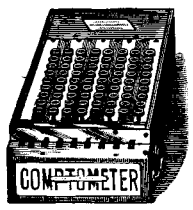

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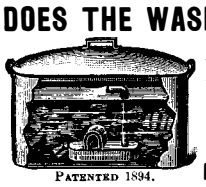

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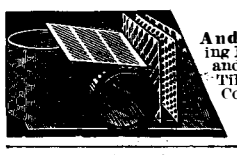

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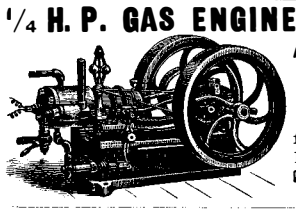

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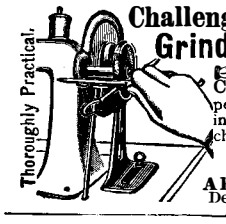

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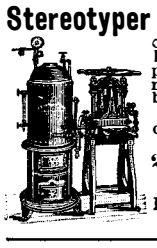

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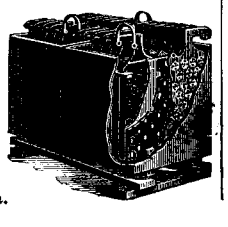

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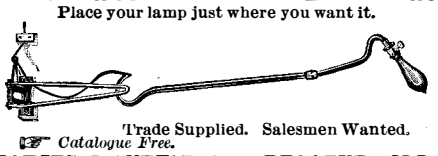

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